UNIVERSITY OF WASHINGTON

ARBORETUM BULLETIN

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PRESIDENT'S MESSAGE

In the past few weeks, a series of events have occurred which are of major importance to the future of the Arboretum.

The long-standing dispute between the University of Washington and the City of Seattle regarding the development and management of the Arboretum in Washington Park has apparently been resolved. Both parties have signed a Letter of Clarification of the 1934 agreement under which the University originally developed and has managed the Arboretum on City park property. The Letter of Clarification specially commits both the City and the University to the continued development and improvement of the Arboretum, but some of the practical problems which surround this agreement make it clear that the Foundation must reassess its methods of support of the Arboretum if we are to be of maximum effect in accomplishing our objectives.

As the City takes a more aggressive position in exercising its management right over the property, the ability of the University to obtain funding for the Arboretum and its program for long-range development is obviously restricted. Under these circumstances, it appears likely that major functions (for example, research and experimentation) of the Arboretum program will be developed at other locations and eventually withdrawn from the Washington Park site, leaving the present Arboretum with facilities such as display gardens, a Vistors' Interpretive Center and facilities for public display and explanation of University-sponsored research and for public education on Arboretum-related subjects.

The University has agreed to match City maintenance funds for the Arboretum, and continues to express its commitment to a long-range development program. It would, therefore, appear that the major challenge to all those interested in the Washington Park site is to support a development program which guarantees a first-quality Arboretum at Washington Park so that broad public support will encourage the continuing commitment of tax dollars to that purpose.

Since the Bylaws of the Foundation presently commit this organization to the development of the Arboretum in Washington Park, the Foundation must also reach a decision regarding its future support of the scientific, educational, research, and display activities which will be carried on at other locations, probably in the Union Bay area of the University of Washington campus.

Your Executive Board and the Board of Directors will be giving a great deal of thought to these problems over the next few weeks. I encourage you to express your views in writing to the Foundation so that we will have the benefit of your thoughts in clarifying our future course of action.

Sincerely,

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THE UNIVERSITY OF WASHINGTON
Arboretum bulletin

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COVER PHOTO:
Magnolia x watsonii flowering in garden of
Mr. and Mrs. Willy de Smedt, Kalmthout, Belgium
(The University of Washington Arboretum has a young speciman which can be found in the Magnolia collection west of Arboretum Drive.)
Photo: Brian O. Mulligan

Arboretum Trompenburg, Rotterdam. View of house from garden.

A *Busman's Holiday* in Europe

*BRIAN O. MULLIGAN**

Part IV — Holland, Belgium and Northern France

In Rotterdam we were met by Mr. R. van Hoey Smith, whose guests we were for the next three days at the Arboretum Trompenburg. The estate had been bought by James Smith in 1850 and the existing house enlarged; the central part of the arboretum had been laid out as an English style garden some thirty years ealier, although little now remains of it. In 1870 the western area of the ten acre arboretum was designed and planted from an still remain, including a fine European yew, a bald cypress (*Taxodium distichum*) and western red cedar (*Thuja plicata*) from the U.S.A. Sheep and Shetland ponies still graze the meadow in summer, a rare sight nowadays within the boundaries of a large city. As a background to this section since 1928 a Pinetum has been planted and now contains some excellent examples, especially of junipers and pines, which succeed very well under the local conditions of soil with a high water table and a climate with colder winters than in England. The generous use of such ground covering plants as *Pachysandra*, various ivies, *Saxifraga* × *urbium* (*umbrosa*), *Vinca minor*, ferns, etc., not only adds much to the appearance of the garden but also greatly reduces maintenance costs.

*Mr. Mulligan concludes the account of his trip to arboreta and gardens of Europe. All pictures are his.

The third member of the family, James van Hoey Smith, controlled the development of the arboretum from 1919 to 1950. The present owner has added a collection of hardy rhododendrons (now numbering six hundred species and hybrids), more conifers, and especially oaks and beeches in which he is particularly interested and of which there are extensive collections. New oak hybrids have appeared here and been named, and new forms of the European beech, some of which were exhibited for the first time in public at the R.H.S. Chelsea Show in London in May, 1973. One of the most extraordinary trees is a weeping form of *Quercus robur*, trained over a pergola. The total collection contains more than two thousand kinds of woody plants. Admission cards are available from the Rotterdam Tourist Office or from Mr. van Hoey Smith.

Since I had previously expressed a wish to visit the ancient Botanical Garden at Leyden (founded in 1587) while we were in Rotterdam, Mrs. van Hoey Smith very kindly offered to lend us her Volkswagen to drive there. So on June 1, we set out, and after some errors in navigation and problems in negotiating the traffic — especially the bicycles and the one-way street system in Leyden — we arrive there safely. Mr. Bruinsma, curator of the Garden, was absent that morning, so we were escorted round by Miss Roder who proved to be a competent substitute.

The original Garden which only measured forty-four by thirty-four yards was laid out in 1594 by Carolus Clusius, then a professor in the University. It is still included (although reconstructed on a different site in 1932) within the boundaries of the present Garden, which was enlarged several times subsequently and now covers about 4.6 acres. Some very ancient and large trees are to be found here, the oldest a *Laburnum* planted by Clusius in 1601 and still flowering each year, although decrepit and much decayed. Others are a tulip tree (1715), a male *Ginkgo* (1785), a Caucasian wingnut (*Pterocarya fraxinifolia*) (1818), a copper beech (1820), besides some derived from von Siebold's introductions from Japan about 1830: a walnut (*Juglans ailantifolia*), *Akebia quinata* growing on the wall of the Orangery constructed 1740-44, and a Japanese quince (*Chaenomeles*). Other parts of the Garden contained formal beds of different plant families, collections of roses and *Rosa* species, of climbing plants on a pergola, a small rock garden and a pool with water lilies. Unfortunately we did not have time to visit the extensive glasshouses, which judging by the published brochure on the Garden must contain a very large and varied collection of tender plants.

On Sunday June 3 we were driven out to Mr. van Hoey Smith's brother's estate on the coast near the mouth of the Maas (Rhine) river. This gave us a welcome opportunity to see something of the native flora of the dunes, which included among woody plants hawthorn, sea buckthorn (*Hippophäe*), common buckthorn (*Rhamnus cathartica*), birches and several species of willow. Of herbaceous plants we noted Solomon's seal (*Polygonatum officinale*) in flower. A gale in April had blown down many planted trees, especially spruces (*Picea sitchensis* and *P. pungens*) and Austrian pines, unable to root deeply enough in this sandy soil with a high water table. Beeches and oaks stood better.

The next day Mrs. van Hoey Smith very kindly acted as our chauffeur and drove us the comparatively short distance from Rotterdam into Belgium, along the main highway leading to Antwerp through Breda, diverging however to the west for Kalmthout soon after crossing the frontier and arriving at the de Belder Arboretum just before noon.

Belonging to Robert and Jelena de Belder, this arboretum is a fascinating and delightful place in which to spend a few days. Originally a nursery in the mid to late nineteenth century, it has been turned into a twenty-two acre combination garden and arboretum during the past twenty years by the industry, imagination and funding of the de Belder family. Many of the trees and shrubs planted long prior to their taking over in 1952 remain and form a background to the more recent additions, among them a big deodar cedar, an incense cedar (*Calocedrus decurrens*) and Port Orford cedars (*Chamaecyparis lawsoniana*) and even a redwood. Of deciduous American trees *Oxydendrum arboreum*, *Nyssa sylvatica* and *Halesia diptera* have all formed

fine specimens, the last in a particularly good variety named *magniflora*.

At the time of our visit several important plant collections were either in flower or about to do so, among them the deciduous azaleas of which red and orange flowered kinds were most evident; rhododendrons, of which a family of seedlings from a cross between *R.* 'Britannia' and *R. yakusimanum* was in full bloom along the side of the lawn behind the house. Generally these varied from a rose-red to pink and were of compact habit, very free flowering. Their future worth remains to be tested.

The large collection of mountain ashes (*Sorbus* species) was in flower, and consequently being continually visited by numerous bees for the nectar produced; one had to be wary when taking photographs. The Arboretum possesses an extensive collection of *Rosa* species and hybrids, most of them now fully grown and of large size, but well pruned to keep them of manageable shape. We were, however, a little too early for the peak display, although *R. rugosa* and *R. pimpinellifolia* (*spinosissima*) and their many hybrids and forms such as 'Agnes' and 'Sarah van Fleet' of the former, and the beautiful 'Lutea Maxima' with its clear yellow flowers and the vigorous 'Fruhlingsmorgen' of the latter species were most decorative and pleasing.

Some other trees and shrubs of special note included a golden leaved form of the American red oak (*Quercus rubra* 'Aurea') a rare tree indeed, but fortunately one which transmits this character to about sixty-six percent of its offspring. A hybrid maple, *Acer* × *zoeschense* 'Annae', apparently intermediate between the field and Norway maples (or a near relative of the latter) was attractive both for its bushy habit, small size (twenty-five to thirty feet) and the prominent long red petioles of the leaves. A superb specimen of *Viburnum plicatum* 'Mariesii', seven feet by ten feet in size, was smothered with its snowy white flowers, while a wall close to the house was completely covered with the handsome and valuable *Clematis montana* in one of its best forms, *grandiflora*, large and pure white.

Two other groups in which we spent some time were the willows (*Salix* species) and

Rose *'Fruhlingsmorgen'* at de Belder Arboretum, Kalmthought, Belgium. Flowers white, 6-8 cm. diameter.

maples, of both of which Kalmthout has many different kinds. Some smaller willows of merit were the prostrate *Salix repens* 'Recondita' with reddish stems; *S. helvetica*, a shrub some six feet tall with gray, lanceolate leaves; and *S. pyrenaica*, about half that height but eight feet wide with shorter and broader, silky leaves and short racemes of flowers. The numerous forms of Japanese maples were then in their young spring foliage and most attractive; there is a walk down one side of the Arboretum where they are concentrated and can all be seen and enjoyed en masse both in spring and fall. Those wishing to learn more about Kalmthout and its plants can read the account of it by Mr. de Belder published in the *JOURNAL OF THE ROYAL HORTICULTURAL SOCIETY*, February, 1969.

In addition to this arboretum the de Belders have another much larger in the making at Hemelrijk, some six miles distant and close to the Dutch border. Here they have about 250 acres of lime-free soil, old trees of beeches, oaks and other species to provide overhead shelter, shade and leaf-fall annually. After eleven year's work much has been ac-

Rhododendron brachycarpum (fauriei) **plants at Hemelrijk Arboretum, grown from Japanese seeds.**

complished. An English landscape architect has been employed, a lake dug out, a nursery with propagating houses formed to grow on young stock. The growth of plants has been very satisfactory; this we especially noticed among the crab apples, willows and rhododendrons. The last are carefully arranged by color to avoid any discordant clashing at flowering time. In another decade Hemelrijk will be a most important arboretum for this region of Europe, as well as a place of great interest and beauty for its visitors.

Leaving our good friends the de Belders and their two very different arboreta on June 9th we went by train from Antwerp to Brussels where we spent a relaxing weekend spending a portion of our time, not with plants, but enjoying instead a first-class art collection of sculpture and paintings at the Musee des Beaux Arts.

The following afternoon we departed by train for Paris, a three-hour run. We were met at the Gare du Nord by other old friends, Professor and Mme. Georges Morel, who drove us to their home near Versailles. This was the beginning of a memorable week spent with them during which we visited two arboreta, two delightful private gardens on the Normandy coast, and the rose garden at Bagatelle.

The day following our arrival, June 12th, was filled by a visit to the Arboretum des Barres at Nogent-sur-Vernisson, some eighty miles south of Paris. Originally founded by P-A. de Vilmorin after his purchase of the property in 1821 and remaining in part in the family holdings until 1936, this arboretum, covering an area of 650 acres, is now a Research Station and Forestry School of the Department of Waters and Forests. Planting, therefore, has been going on, except for intervals caused by three wars, for about a century and a half, with the result that the visitor can see one of the world's greatest collections of mature trees and shrubs of the temperate zone within a comparatively small and rather closely planted area.

The area is divided into a number of separated sections, including the Arboretum Pardé and the Arboretum Gouet, named for former Directors; the Fruticetum or shrub collection, planted by Maurice de Vilmorin in 1890; and six or seven others, each used for a particular type of tree or trees, or those requiring special soil conditions. About 140 acres are occupied by a forest arboretum where trees are planted in larger numbers for observation over a long period.

Within sight of the chateau, built about 1890, is a most unusual and extraordinary collection, planted in 1942, of conifer cultivars of different forms and coloring: gray, silver, and golden leaved forms of *Chamaecyparis*, spruces, true firs, cedars, and even Douglas firs; columnar types, of which *Cedrus atlantica* 'Fastigiata' (fifty feet) and *Abies pinsapo* 'Pyramidalis' were particularly striking. One of the most abnormal, however, was a specimen thirty-five feet tall of the weeping giant sequoia (*Sequoiadendron giganteum* 'Pendulum'). A very blue-gray

A remarkable specimen of the weeping giant Sequoia (*Sequoiadendron giganteum* 'Pendulum'), about 35 feet tall, at Arboretum des Barres.

A handsome tree of a Chinese Catalapa, *C. fargesii*, in flower at the Arboretum des Barres. Height approximately 50 feet.

Picea engelmanii 'Glauca' at the Arboretum des Barres. 8 feet high, 10-12 feet wide.

selection of our native Engelmann spruce (*Picea engelmannii* 'Glauca'); measuring about ten to twelve feet in width but only seven to eight feet high, was most decorative. A form of our native Alaska cedar *(Chamaecyparis nootkatensis)* with variegated foliage was also found here.

After lunch in the small town we strolled leisurely through the arboretum areas near the service buildings beside which was a splendid specimen of the rare Chinese *Catalpa fargesii* forma *duclouxii* in full bloom, some fifty feet in height, much more columnar in form than our native American species. Nearby also were excellent examples of *Cupressus glabra* (or perhaps *C. arizonica*) from our southwestern states and a large Spanish fir *(Abies pinsapo)*. Our native western yellow Pine *(P. ponderosa)* was about sixty feet tall.

The wealth of mature species to be seen here is truly astonishing, as is the fact that many of them have been raised from seeds sent home from China by French missionaries. Among conifers we noted a Chinese white pine *(P. armandii)* about sixty-five feet tall, coning freely, as were the elegant *Picea morrisonicola* from Taiwan and the Japanese *Pseudotsuga japonica*, about thirty feet in height. It is worth noting here that this collection has been the chief source of seeds for our own Arboretum for these and many other unusual conifers as well as some deciduous trees and shrubs, and that we now have trees of many of them growing well and producing cones.

Of deciduous trees we found more rare specimens from Asia, including a linden *(Tilia henryana)* from western China, and beside it the handsome Japanse birch *(Betula maximowicziana)* with leaves up to six inches in length, an attractive small beech from Korea *(Fagus multinervis)* which I have seen nowhere else, *Acer grosseri* var. *hersii* now becoming more familiar to growers here, and *Acer opalus* from southern Europe, a species valuable for its conspicuous flowers in spring but seldom grown in this country.

The Fruticetum, where we spent an hour in the late afternoon, is divided up into a number of long, parallel beds where shrubs belonging to various families are grown together, a convenient method both for purposes of comparison and also for maintenance. Some of the genera seen here were *Cotoneaster, Rosa, Spiraea, Viburnum,* including a large specimen of *V. sieboldii* from Japan, considered by Dr. Donald Wyman to be one of the most ornamental species, but one seldom seen in the Pacific Northwest. Fences supported such climbing plants as *Vitis, Celastrus* and *Clematis*. In the *Ericaceae* collection we found a magnificent example of the eastern American deerberry *(Vaccinium stamineum)* in full bloom, more than five feet high and twice that in width. This we had to record on film, both in color and black-and-white!

Around the perimeter of this ground were some fine and interesting trees, especially one of the original dove trees *(Davidia involucrata* var. *vilmoriniana)* raised from seeds sent from central China by Father Farges in 1897 and flowering for the first time here in 1906. Others were the elegant Chinese spruce *(Picea brachytyla)* about forty-five feet tall and coning (we have several young specimens in our own Arboretum); a sixty foot example of the big-cone Douglas fir *(Pseudotsuga macrocarpa)* native in the mountains of southern California, also coning freely;

An old plant of *Picea glauca* 'Conica' at Arboretum des Barres, reverting to the type at the top. With the late Prof. Georges Morel.

and finally, a good speciment of *Magnolia fraseri*, a tree from the mountains of the southeastern states. On the way back to our car we discovered an old example of the dwarf *Picea glauca* 'Conica,' the upper part of the plant reverting back to its parent, a novel occurrence in my experience.

Just on the outskirts of Versailles at Rocquencourt is the Arboretum Chevreloup belonging to the Museum of Natural History, Paris. Here we were taken by Professor Morel on June 14th and spent most of the day seeing some of its 600 acres under the guidance of the Director, Monsieur G. Callen.

The oldest plantings are about forty-five years old, the majority between thirty and forty years. Conifers predominate in this open, grass-covered landscape. Judging by their growth and appearance the soil beneath must be of good depth and quality. The spruces (*Picea* species) seem particularly happy here. We saw handsome young specimens: *P. asperata* and *P. brachytyla* from China; *P. koyamae* from Japan; *P. obovata* from Siberia; and from North America, *P. pungens, P. engelmannii*, a trio of the Siskiyou spruce *(P. brewerana)* twenty-five to twenty-eight feet tall, and a fine example of our native Sitka spruce, branched to the ground. Firs *(Abies)* were also well represented by about thirty species from various parts of the world, as were pines, which included good examples not only of our western yellow pine *(P. ponderosa)* and the Californian digger pine *(P. sabiniana)* but also three healthy trees of the Mexican *Pinus montezumae*, thirty-five to forty feet tall, a difficult tree to grow in the Seattle climate. Port Orford cedars *(Chamaecyparis lawsoniana)* were flourishing, while among the junipers was a fine specimen of the rare, columnar Syrian *Juniperus drupacea* about thirty feet in height.

But perhaps the most remarkable coniferous trees here were those in the long avenue of true cedars, hybrids between the Lebanon and Atlas Mountains species *(C. libani* and *C. atlantica)*, showing as might be expected, great variation both in habit and leaf coloration. These trees are about forty-five years old, fifty to sixty feet in height, and

Spruce trees at Arboretum Chevreloup. *Picea brewerana* on right.

Tree of *Sophora japonica*, approximately 225 years old, at Arboretum Chevreloup.

have ample room to develop in the future.

Among the deciduous trees in this area were several unusual kinds: both the Japanese *(Z. serrata)* and Chinese zelkovas *(Z. sinica)*, the latter an attractive smaller edition of the former but regrettably rare in cultivation; a variegated form of the Norway maple (*Acer platanoides* 'Walderseei') and several examples in tree form of our native vine maple *(Acer circinatum)* twenty to twenty-five feet tall. A short avenue had been planted of the Chinese cedar *(Cedrela sinensis)*, a tree much resembling the Tree of Heaven *(Ailanthus altissima)* especially in the long pinnate leaves, but less rounded and compact in form. By far the largest and oldest tree here, however, is a magnificent specimen of the so-called Japanese pagoda tree *(Sophora japonica)* which is really a native of China and Korea. This is no doubt one of the original trees introduced to France in 1747 by a Jesuit missionary living at Peking (the first introduction to Europe), making it about 225 years old and now approximately 100 feet in height.

The next two days we spent with Prof. and Mme. Morel visiting two quite different private gardens close to the coast of Normandy, a little west of Dieppe.

The first of these was Le Bois des Moutiers, an estate acquired in 1897 by Guillaume Mallet on which was constructed in the following year a house of stone and brick designed by Sir Edwin Lutyens, one of the leading young English architects of that period. The house stands on a plateau facing north to the English Channel (La Manche); in front of it is a wide grass lawn; at each side a sheltering plantation of mature oak, beech, pine and other trees, beneath and in front of which have been planted groups of rhododendrons, azaleas, *Pieris* and other shrubs intended both to strengthen the windbreak and also to provide splashes of color in due season.

We were most fortunate to be conducted round the garden by Mme. Andre Mallet, present owner of the estate and well qualified to provide us with firsthand information. Much thought has obviously gone into the planning of the garden, originally the work of

View across rose garden at Bagatelle.

Miss Gertrude Jekyll, an English designer and authoress who frequently collaborated with Lutyens. Groups of particular plants provide color and often fragrance at different seasons: *e.g.,* magnolias in April, rhododendrons and azaleas in May and June, with roses in the latter month also, followed by hydrangeas in July and August and fall color from swamp cypresses, sweet gums, Japanese maples, *Cercidiphyllum japonicum*, and others. Suitable herbaceous plants are also used in places where they are appropriate and succeed.

Because of the maritime climate and the sheltered valley descending to the coast, many evergreens flourish, including besides those already mentioned, camellias, bamboos, and the handsome hybrid *Eucryphia* x 'Nymansay' which flowers in August. I was especially interested to see large examples of the old hybrid *Rhododendron* 'Halopeanum' *(R. griffithianum* x *R. maximum)* raised at Nantes in northwest France in 1890 and later used by Sir Edmund Loder in England to produce *R. 'Snow Queen'* (*R.* 'Halopeanum' x *R.* 'Loderi'). The flowers, borne in loose trusses, are creamy white in color, but at this time were almost over.

Mme. Mallet has formed an "Association des Amis du Bois des Moutiers" so that the garden and its surroundings may be preserved in the future. We understand this to be the first such dedication of any garden in France; it is certainly one well worthy of both local and wider support to maintain it.

The second garden, belonging to Prince and Princess Sturdza, was close by in the same area, but placed among pine trees somewhat farther back from the coast, with mixed woods of oaks, beech and hornbeam for shelter on the southwest side. The house was formerly owned by the composer Albert Roussel (who is buried in the village churchyard). Its walls were decorated with various types of climbing roses now in bloom.

The garden has been developed by the Princess during the past fourteen years and consists primarily of two major areas: first, the woodland area near the house, and secondly, a long, open grass-covered valley and slope towards the west, the latter a more recent development. Two Dutch girls were working in the garden at the time of our visit, but the mowing of nine acres of grass requires more assistance.

The woodland has been very carefully and skillfully planted to form irregular beds among the pines and other trees, using plants of high quality, especially of rhododendrons, azaleas and camellias (both species and hybrids), the last including *C. reticulata, C. japonica*, and some of the *C.* x *williamsii* hybrids. Among them grew drifts of primulas of the *Candelabra* section, matching or blending with the azaleas as far as possible. Other herbaceous plants thriving here included both blue and yellow Himalayan poppies *(Meconopsis), Rodgersia, Hosta* and *Iris* species, while various bulbs such as daffodils, scillas and *Tulipa* species were used to lengthen the season of bloom.

After lunch on the lawn near the house we were shown the later plantings on the slopes of the valley, among which a variety of *Rosa* species and single-flowered hybrids was very evident and interesting. They included the so-called Austrian briar *(Rosa foetida)* with bright yellow flowers, a native of Turkey;

Vista in woodland garden of Prince and Princess Sturdza, near Dieppe, Normandy.

various hybrids of the Japanese *R. rugosa*, mostly highly fragrant; and the European *R. spinosissima* with pale and bright yellow forms. A most unusual large shrub was a selected pale lavender form of the Chilean *Abutilon vitifolium*, named 'Veronica Tennant.' Birches and hollies had been placed here for winter effect, while at the top of the slope was a recent grouping of young pine trees, with a large bed containing *Hamamelis* for spring flowers, hydrangeas for summer—a novel combination to us, but likely to be quite effective.

The banks of the small stream in the bottom of the valley had been very successfully planted with plants enjoying such moist conditions: small kinds of willows, astilbes, hostas, iris, and again the tall *Candelabra* types of *Primula (P. japonica, P. pulverulenta,* and *P. beesiana)*. The patterns of foliage as well as flowers here would have made this attractive through the summer. Nearer the house a cutting garden supplied flowers for decoration indoors. For so young a garden a great deal has been accomplished in a short period of time, and undoubtedly it will mature and improve as time passes. Princess Sturdza is much to be congratulated on the results of her planning and hard work thus far.

One other day in this area remains to be mentioned, Saturday June 16th, when we spent the afternoon with Professor and Mme. Morel in the grounds of the park of Bagatelle within the larger domain of the wooded Bois de Boulogne on the western side of Paris.

Since the early eighteenth century Bagatelle has had a remarkable and involved history which it is not necessary to detail here expect to say that it has been public property since 1905 when it was purchased by the city from the heirs of Sir Henry Murray Scott. It had been in English hands since the Marquis of Hertford in 1835 bought the estate which at that time amounted to some twenty-five acres.

During his thirty-five years of occupancy Lord Hertford extended this to sixty acres, and in 1860 reconstructed the charming little chateau originally built in 1777 by the brother of King Louis XVI, adding the formal but very simple garden on the north side. Lord Hertford was also responsible for the complementary Orangerie, a new entrance with lodge, a tea house, the gardener's house, the water garden and a maze.

His successor, Sir Richard Wallace, continued to make improvements during the next twenty years until his death in 1890. However, the rose garden was not constructed until 1903, and the international rose trials only initiated in 1907 through the instigation of J. C. N. Forestier. This is the chief reason for the present fame of this small but highly cultivated garden.

At the time of our visit the roses were almost at their peak of bloom and made a dazzling display of color. The plants are set in beds of various shapes and sizes surrounding a rectangular grass plot about the length of a tennis court, though not as wide. On the east side a grassy mound surmounted by the Empress' kiosk overlooks the whole scene.

All types of roses are to be seen and admired or criticized as the case may be: bushes, standards on four-foot stems, half-standards, climbing kinds grown on several posts set close together or on ropes or chains extending between posts. It was a remarkable sight to see so many of differing shapes, sizes and shades of color all in bloom or nearly so at this time.

In the section devoted to the new introductions I noted more than 200 under numbers awaiting judgment by the international committee, the majority of bush types but including a few miniatures. Among the older kinds a bed of perhaps fifty plants of 'Elizabeth of Glamis' was outstanding with its glowing peach-pink flowers on strong stems. Others noted were 'Istar,' a vermilion-orange; 'Joseph's Coat,' a bicolor from Armstrong of California; the white 'Allegra,' and for a white pillar rose, 'City of York.' Not being a grower of such plants I did not take many notes on their names; no doubt they are reported in the journals of the various rose societies.

Some excellent old specimen trees are to be found in the park, many of them planted by Lord Hertford about 1860. Among them are a weeping European beech (*Fagus sylvatica*

(continued on p. 34)

The Life and Loves of Lichens

or

Two Can Live as Cheaply as One

*JOY BELSKY**

An old twig of red cedar *(Thuja)* with *Ochrolechia*, a crustose lichen (middle) and *Parmelia*, a foliose lichen (bottom and top). (Snail—*Monadenia fidelis*.) (Approximately natural size.)

Even the most casual visitor to the Washington Park Arboretum on a dull December day, or to a wintry forest in Western Washington, will be struck by a major difference between the conifers and hardwoods. Besides the obvious fact that one tree type is green and the other isn't, one notices the myriad shapes and colors of the lichens on the trunks and stems of the deciduous maples and alders, but few, if any, on the Douglas Fir, spruce, and hemlocks. Although the question why lichens prefer hardwoods to conifers, is, in itself interesting, the curious naturalist may be more puzzled by the question why we call a flat, dry, brittle, paper-thin organism that has no roots, stems, or leaves, a plant. And although it may be gray, black, red, yellow, or orange, it still has green chlorophyll and produces its own food through photosynthesis. But lichens are even more mysterious than this. They may be recognized as the incongruous splotches

*Ms. Belsky is a graduate student in the Botany Department at the University of Washington.

of color on otherwise dull gray rocks; as long, thin threads hanging from trees; and as the fruiting bodies which periodically appear on bare rocks. Various lichens may grow, often more successfully than any other life-form, on snow and ice in the arctic and antarctic; in the hottest deserts, on large flightless weevils in New Guinea, submerged most of the year in lakes, on salt-sprayed sand dunes, in soil, and on the occasional giant Galapagos turtle. Different species of lichens can survive extreme heat (to 60°C or 140°F), extreme cold (to nearly −273°C or −459°F, absolute zero), desiccation (up to three years without water), and the most deadly ionizing radiation.

The resistance shown by lichens to extreme environmental conditions has led various scientists in the past to speculate that lichens may be the dominant vegetation on Mars, a place of low temperatures and little water. They could be responsible for the seasonal color changes of the Martian landscape which occur as the polar caps melt. A terrestrial lichen, *Umbilicaria dillenii*, shows a similar color change from green when moist to black when dry.

As lichens are among the most hardy of earthly organisms, this theory might have gained acceptance, except that the proponents go too far and add another reason for advocating lichens as being the extraterrestrial plant forms: they add that lichens are primitive organisms that never evolved into more complex forms in the unfavorable Martian environment. This word "primitive" causes lichenologists to bristle as would an anthropologist when some culturally biased person referred to certain tribes in Africa as being primitive. Different from what our value judgements recognize as being advanced — yes! Primitive — no!

A lichen may be rootless, stemless, leafless, and flowerless; but there is nothing primitive about an organism that is a tightly integrated composite of two species belonging to completely different plant divisions, the Fungi and the Algae. (Some even think these are in different kingdoms.) Species from these two plant divisions have evolved and grown together so closely in forming a lichen that one or both cannot survive independently without the other. In fact, only in the last hundred years have lichenologists discovered and slowly come to accept the duality of the organism. The last attempt to disprove this theory was published as recently as 1953.

What is the nature of this tightly interwoven growth and dependence of alga on fungus and vice-versa? It is called symbiosis, the physical and physiological union of two different organisms. Among the 16,000-18,000 species of lichens, the relationship ranges from out-right parasitism of the fungus on the alga, to mutualism with each member being completely dependent on, but not injuring, the other for life and growth. In lichens, the symbiotic relationship has progressed so far that the composite organism, the lichen, is a new and unique entity, physically and physiologically different from either symbiont (a partner of a symbiotic relationship). Members of other symbiotic pairs—protozoans living in termite guts or green algae growing within the tissue of *Hydra*—maintain their original shape and most of their biological systems, though they are still dependent on each other for nourishment and/or protection. But the lichen is different from either symbiont cultured alone. It looks different, produces different metabolic compounds and pigments, has different reproductive structures, and has a much longer life-span than free-living algae or fungi.

Not only is the lichen itself a highly evolved organism, it could have commenced this interdivisional affair only after evolution of the highly specialized algal and fungal species. Most algal symbionts, called phycobionts, are green algae (Chlorophyta), though a small percentage are blue-green algae (Cyanophyta) or yellow-green algae (Xanthophyta). The fungal partner, mycobiont, is usually an Ascomycete, or more rarely a Basidiomycete. It is the presence of these modern plant classes which causes lichenologists to scorn the word "primitive."

The Martian-lichen theory becomes a little more acceptable when proponents suggest that the lichens arrived, fully evolved, by some extraterrestrial space flight from earth. A strong wind indeed! Or perhaps this

could provide more support for Däniken's *Chariots of the Gods* theory.

Basic biology of lichens

The symbiotic relationship might be clearer and more highly appreciated if I described, in general terms, the morphological and microscopic features of lichens. Morphologically, lichens can be separated into three groups: crustose, foliose, and fruticose. The crustose type is the simplest growth form, physically and evolutionarily. As its name implies, these lichens, such as *Catillaria, Rhizocarpon*, and species of *Lecanora*, form a crust, sometimes up to many centimeters in diameter, and are intimately attached to rocks, tree trunks, soil, and leaves. This is the form that I, as a child, puzzled over and finally identified as paint that had splashed out of some bucket, even though it often occurred miles from the nearest painted structure. The rock with fruiting bodies is, in reality, a rock with a crustose lichen such as *Lecidea liguriensis* growing between the crystals below the rock's surface. Its presence is noticed only when it sends up reproductive structures.

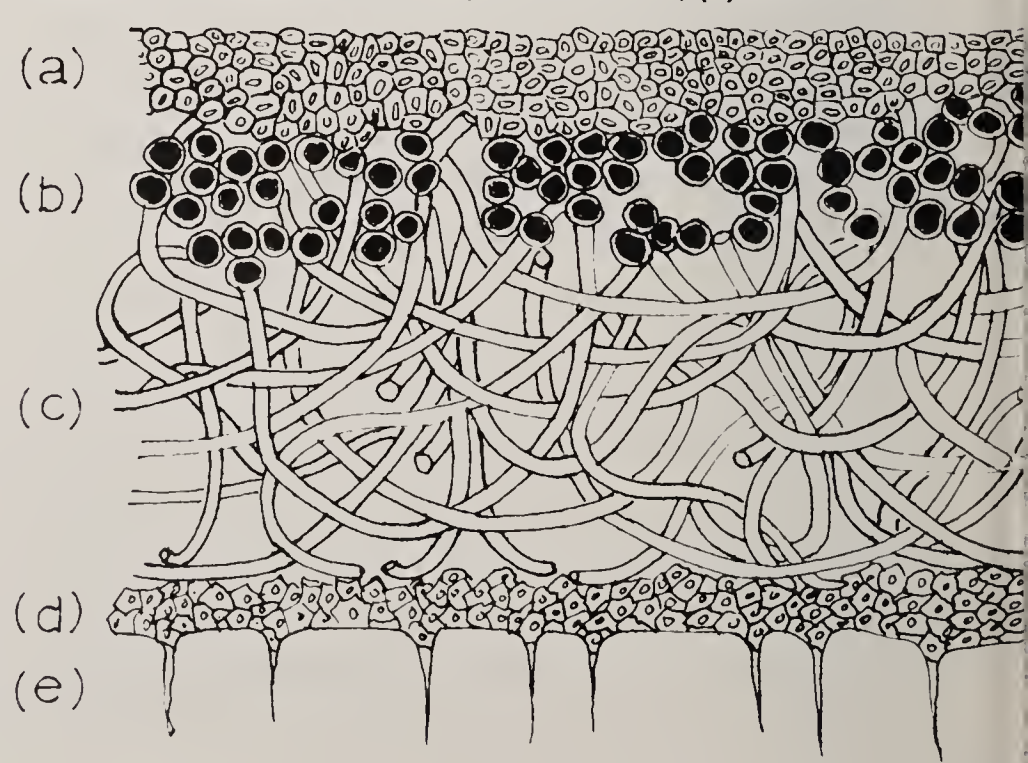
Foliose lichens, also well named, have leafy forms with exposed lower as well as upper surfaces. The lichen thallus (the word given to non-vascular-plant bodies for which words like leaf, stem, and root are inappropriate) is round and flat, grows circumferentially in all directions, and may be more than 20 cm in diameter. The thalli of *Lasallia papulosa* and *Umbilicaria mammulata* are attached to their substrates by a central umbilicus, leaving the edges to curl up and fold over as leaves do. Other foliose lichens such as *Parmelia austrosinensis* are attached at several points, but their edges still rise above the substrate.

The fruticose lichen has the most advanced thallus form—either shrubby and erect, or hairlike and hanging, or fingerlike and branching. This morphological advance parallels the growth habit of vascular plants which gradually evolved erect statures or the ability to climb and hang from other structures. Both morphological forms enabled them to capture more sunlight. The genera *Cladonia*, reindeer moss, and *Cetraria* are shrubby, frutcose lichens which form the ground cover in the arctic. *Usnea* is the wispy-hanging lichen found hanging from trees in many parts of the world. On the Olympic Peninsula, where it is known as "old man's beard," *Usnea* can often be seen attached to alders.

A microscopic view through a lichen thallus reveals how the symbiotic alga and fungus species are interwoven. The lichen is composed of distinct layers (see Figure 1) which once again parallel the development in advanced plants. The leaves of flowering plants (Figure 2) and the thalli of lichens have much in common. Instead of having a protective layer of epidermal tissue, lichens are covered with a thin layer of fungal strands (hyphae) called the cortex. Crustose lichens have only an upper cortex; foliose and fruticose lichens have both upper and lower cortical layers. The cortex doesn't seem to prevent water loss as well as does epidermal tissue, but its opacity protects the algae from intense, destructive insolation.

Below the upper fungal cortex is the algal layer, occupying the same position as the photosynthetic palisade parenchyma cells in the leaves of higher plants. The algae, either green, blue-green, or yellow-green, are always unicellular species. Each algal cell is completely surrounded by the special hyphal strands called haustoria, which extract nourishment from the alga for the non-

Fig. 1. Lichen, section through thallus: (a) upper cortex; (b) algal layer; (c) medulla; (d) lower cortex; (e) rhizines.



photosynthetic fungus. The haustoria in certain species are closely appressed to the algal cells, absorbing nutrients as they leak out of the green cells. Other fungal species have haustoria that penetrate the algal protoplast for nutrient absorption. Lichenized algae have unusually leaky cells, which probably evolved to enhance the symbiotic relationship.

The medulla lies below the algae and makes up the bulk of the lichen thallus. It is composed of loosely interwoven hyphal strands, some of which are directly attached to the substrate. These anchor crustose lichens and often make the removal of the organisms impossible. The medulla functions as an organ for food and mineral storage. Water is mostly adsorbed from surface moisture onto the fungal strands of the medulla but it is held loosely and is easily lost.

The final layer is the lower cortex and its root-like rhizines. The rhizines function to attach the lichen to the substrate and have no water absorption capability.

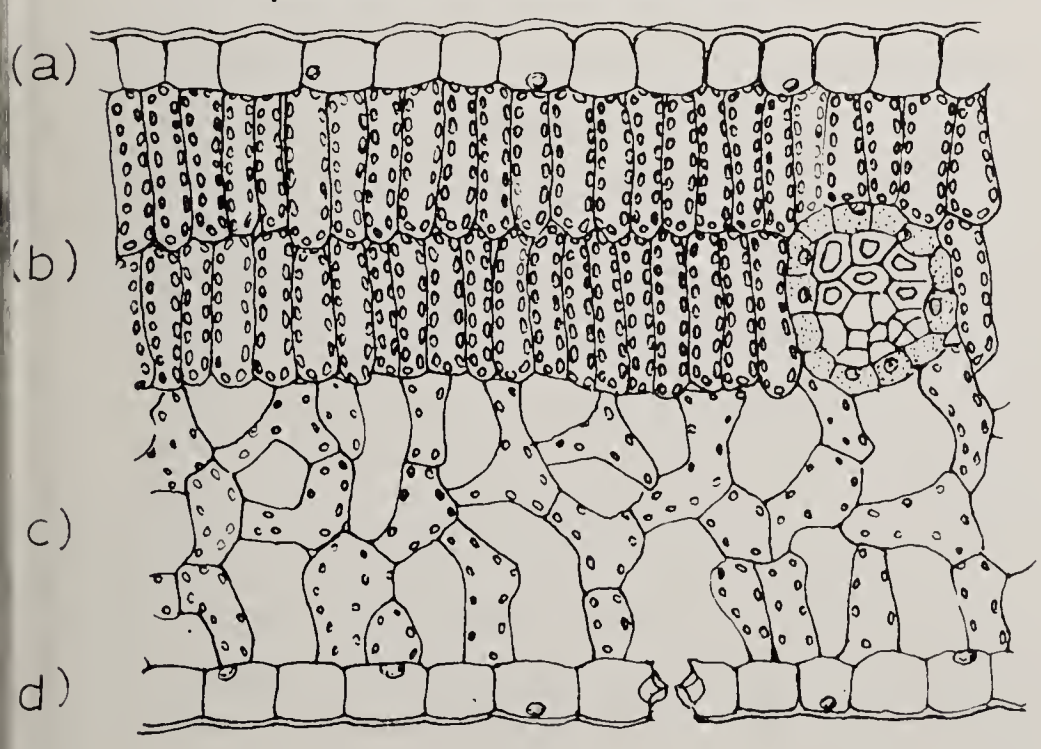
The lichen's cellular structure provides the key to understanding how and why this unique organism evolved. The interdigitation of two separate plants provides the most efficient structure for the mutual give and take of symbiosis. The fungus obtains its food—sugars and other carbohydrates—from the alga, as well as some vitamins and perhaps other necessary compounds. Certain blue-green algae, such as *Nostoc*, fix atmospheric nitrogen and are ready sources of nitrate for protein synthesis. And for some unknown reason, fungi that are lichenized live longer than free-living fungi.

The benefit to algae from living in symbiotic relationships with fungi is not so clear. In fact in many cases the alga species have been found to grow independently in nature. Sometimes the fungus-alga relationship is one of parasitism with all the benefit going in one direction—to the fungus. The phycobiont in this somewhat primitive relationship is slowly killed by the loss of nutrients. But in the truly mutualistic lichen, the alga is more closely co-evolved with its fungal partner and is dependent upon it for vigorous growth. The greatest benefit for the phycobiont is protection by the fungus. The mycobiont protects the unicellular algae from mechanical damage by the elements, from desiccation in dry periods, and from extreme light intensities. The common phycobiont *Trebouxia* is very sensitive to high insolation and flourishes when surrounded by opaque hyphal strands. Protection against excessive light may be the chief function of the many acids and orange and yellow pigments deposited in the lichen cortex. The alga also obtains minerals and water held in the medulla.

This composite anatomy produces a very self-sufficient plant. It manufactures its own food, using only inorganic materials, which a non-lichenized fungus cannot do; and it is protected from the harsh realities of the abrasive, desiccating terrestrial environment which most algae are not. As a result, lichens have been able to adapt to the very extreme environments mentioned above. However, their distributions are limited by these same attributes. Lichens cannot grow in dark crevices and under logs as can fungi; they need light for the photosynthetic algae. Neither have they adapted to year round marine environments as some algae have.

Lichens have no roots to absorb, nor organs to store, water; they can long survive, but not photosynthesize, without it. Vascular plants, with their roots, can absorb water

Fig. 2. Leaf of flowering plant, cross-section: (a) upper epidermis; (b) palisade parenchyma with chloroplasts; vascular bundle on right; (c) spongy parenchyma; (d) lower epidermis with stomatal opening.



from underground sources and thrive in extremely arid areas where lichens are unlikely to grow. The flat lichen thallus is also less efficient than the thick succulent desert plants which store water in stems and leaves for use throughout the dry season. The lichen dries out in a matter of hours. But lichens have one adaptation vascular plants do not possess—the ability to absorb water vapor out of the air. Consequently, areas of low rainfall but heavy fog or dew, such as the coast of Northern California, are rich with lichens.

The last physiological problem of this symbiotic organism which has been more efficiently solved by higher plants is the absorption of minerals from the external environment. Vascular plants obtain minerals, such as nitrates and salts of calcium, magnesium, etc., through their roots. The minerals are dissolved in the soil water. Lichens have to wait till the necessary minerals fall on their surfaces from the air or wash over their thalli in rain water. Lichens growing on tree trunks in the Pacific Northwest probably absorb nutrients leached out of bark by the copious rainfall.

Lichens are qualitatively and quantitatively selective in the minerals they absorb. They accumulate more phosphorus, magnesium, iron, and aluminum than is found in the environment, but have less sulfur, manganese, potassium, and calcium. Unfortunately for the Eskimos and Laplanders, lichens have a great affinity for the rare elements, strontium and cesium. Above-ground atomic bomb testing over the last thirty years has dumped the radioactive isotopes, strontium 90 and cesium 137, into the atmosphere. These radionuclides have fallen out in the arctic and sub-arctic regions where the boreal peoples live and graze their reindeer and caribou. The highly resistant fruticose lichens, *Cladonia* and *Cetraria*, accumulate the radioactive elements in amounts often three to ten times greater than do the neighboring flowering plants. Since these lichens may constitute 60%-95% of the winter diet of caribou and reindeer, these animals accumulate large amounts of radioactive minerals in their bodies. As the boreal herders eat the meat and organs of their animals, they ingest high concentrations of cesium 137 and strontium 90, the most harmful long-term contaminants to man. Eskimos and Lapps who are dependent on lichen-foraging animals are receiving doses of radiation twice those due to natural external causes and carry body burdens as high as 1/3 the maximum permissible safe level. No symptoms of radiation sickness have yet been seen, but there is some concern over the long term effect of this high level.

Reproduction

Sexual reproduction is a pretty tricky business at best, but it is especially tricky when spores from two different organisms have to get to the same place at the same time. The dualistic lichens have solved this problem by more or less avoiding it and becoming pretty good at asexual, or vegetative, reproduction. The most obvious method is simple fragmentation. Since each piece of the lichen thallus is exactly like every other piece and contains both the phycobiont and the mycobiont, fragmentation due to mechanical abrasion or some other environmental factor easily establishes new colonies in new areas. A kick in the dirt by a deer or a slip on a rock by a mountaineer could tear off fragments of lichen and send them to new homes centimeters or meters away. A rainstorm, avalanche, or strong wind can tear off pieces of thallus and transport them long distances. The same could be done by birds and mammals with minute parts of lichens clinging to feathers or fur.

Lichens have also evolved small structures called soredia and isidia to facilitate asexual reproduction. Neither of these specialized structures are produced by non-lichenized fungi or algae, probably because these plants do not have the same problem of transporting reproductive propagules from two different species at the same time. Soredia are simply small clumps of algal cells interwoven with fungal hyphae which escape from cracks in the cortex of lichens (Figure 3). By this device the symbionts are together blown or carried, or fall, to new habitats. Isidia (Figure 4) are finger-like protuber-

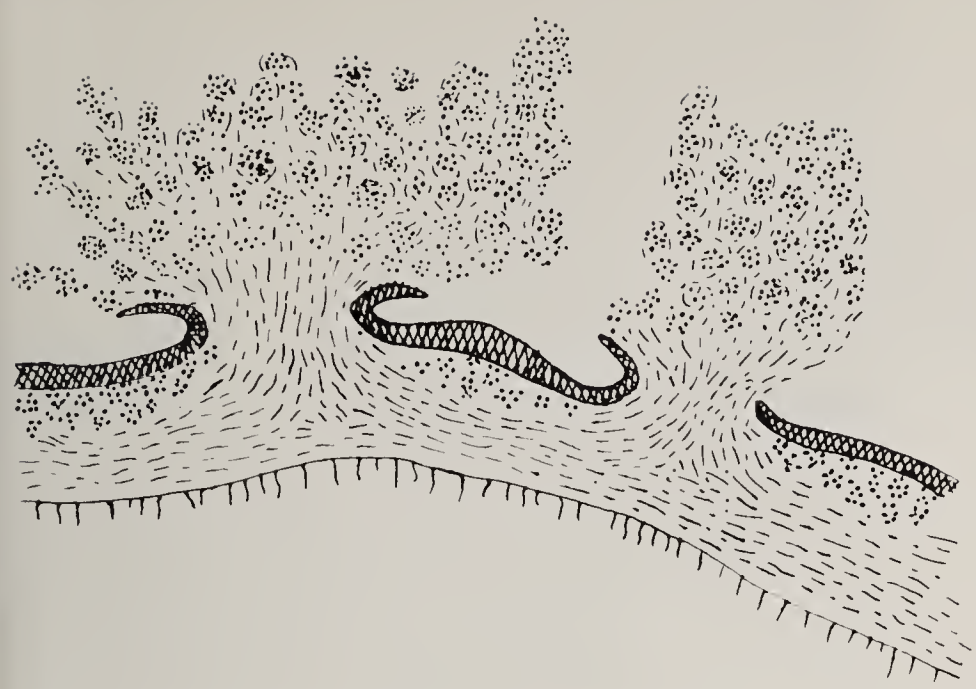


Fig. 3. Lichen: formation of soredia.

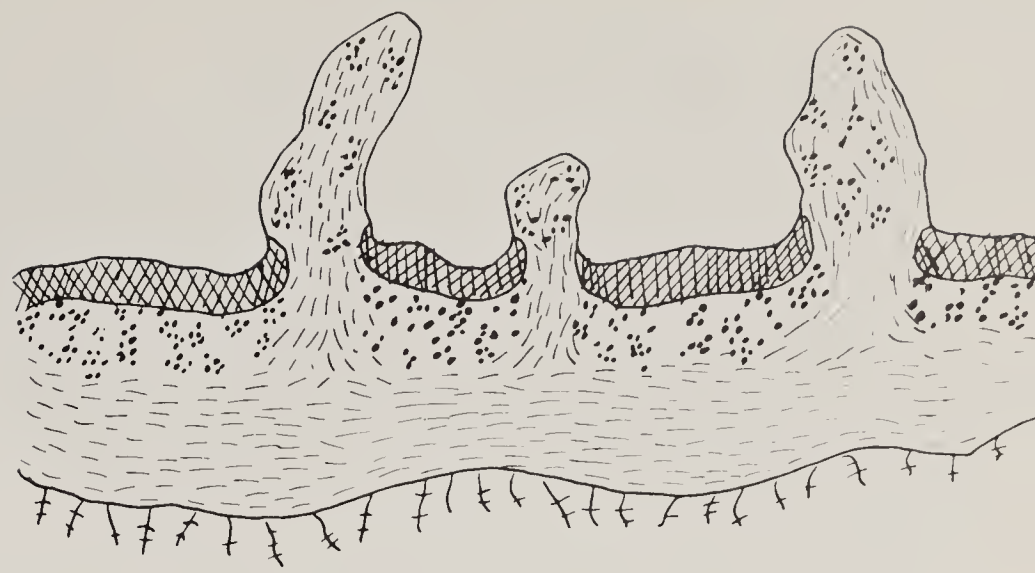


Fig. 4. Lichen: isidia.

ances from the upper thallus which are composed of an interwoven mass of fungus and alga. These structures are very small (0.1-0.3 mm), and fragile, and pieces easily break off. If conditions are favorable, the algal and hyphal cells from the soredia or isidia divide asexually and gradually produce new cortical, algal, and medullary layers.

Sexual reproduction does occur in many species of lichens but it is thought to be a primitive trait left over from pre-lichen life-styles. Even in sexual reproduction the plants have not evolved the ability to produce and distribute fungal and algal spores at the same time. Therefore, only the fungus produces spores. It is somewhat of a mystery how the alga is distributed, although at least one authority thinks that algal cells may escape from soredia and isidia.

The sexually reproducing lichen (referring only to the fungal component) produces characteristic ascocarps (when an Ascomycete is the mycobiont) or basidia (when a Basiodiomycete is the mycobiont). At maturation the spores are released into the environment unaccompanied by algal cells. It is only conjecture as to what happens next in nature. Two pathways have been proposed, both of which may be valid for different species:

#1 The spore germinates and hyphae quickly grow into a mat. If it makes contact with one of a number of algal species which it can incorporate, the partners mature into a lichen thallus. If no suitable algae are present, the fungus dies.

#2 The fungal spores lie dormant (sometimes for months or years) until contact with some suitable algal species is made. At that time the spores germinate and the hyphae grow around the alga to produce a new thallus.

Both suggestions assume that fungi can live independently for at least a short time in nature (suspected to be true of only certain tropical lichens), and can incorporate one or more of a number of algal species (known to be true). They also assume the algal symbionts can live in the unlichenized state (true), are well distributed in nature (not true of all phycobiont species), and have some method of reproduction and distribution not as yet recognized.

Economic importance

Even though they are often edible and have high food value, lichens have seldom been utilized by man as food. Species of *Umbilicaria*, the rock tripes, are eaten in Japan in salads or fried in fat; and arctic peoples sometime utilize lichens as a source of gelatinous substances. Most fascinating in the conjecture that the foliose lichen *Lecanora esculenta* was the fabled manna of the Bible. It is edible and it grows abundantly in the desert of the Middle East.

As already mentioned, caribou and reindeer depend on the fruticose lichens *Cladonia* and *Cetraria* in the winter, as do lemmings and other arctic animals. *Lecanora esculenta* is also said to be grazed on by sheep in the Libyan desert.

Throughout history, lichens have probably been valuable as dyestuffs. Various pigments produced by the lichens were (and

(continued on p. 33)

Old twig of plum tree with various types of lichens: *Parmelia* species, foliose lichens (top) and *Usnea* species, fruticose lichen (middle, right). (.5 x natural size.)

Lobaria retic

A rock-dwelling *Lecanora*; a related species *(Lecanora esculenta)* may well be identical with the biblical manna. (1.4 x natural size.)

Pieces of old cedar stump *(Thuja)* with *Cladonia* species. Some *Cladonia* species are known as "British grenadiers" because of the scarlet fructifications. Reindeer moss, *Cladonia rangifernia*, is important in the arctic tundra. (0.6x natural size.) (Inset: 1.3x natural size.)

a, one of the bigger foliose lichens. (.65x natural size.)

Lobaria crustosa, one of the larger foliose lichens. (1.1x natural size.)

Various Examples of the Three Types of Lichens

Photos: B. J. D. Meeuse

Rhizocarpon, a strikingly colored lichen dwelling on rocks (chartreuse-yellow, surrounded by black). (1.5x natural size.)

Arboretum Classes / Fall Quarter, 1974

FALL TOURS. Mr. Joseph Witt, Plant Curator, will conduct tours of the Arboretum in fall color, including the Oak Section and Woodland Gardens. Class limited to 25. Saturdays, Sept. 28, Oct. 19, Nov. 2; 9-11 a.m. Meet at Arboretum office. 3 sessions, $5.

PRUNING ORNAMENTALS. Mr. Chico Narro, expert nurseryman, will demonstrate techniques of pruning trees and shrubs. Arboretum greenhouse; class limited to 30. Saturdays, Nov. 2 and 16; 10-12 noon. 2 sessions, $5.

HOUSE PLANTS. Dr. William Hathaway of the Arboretum staff and College of Forest Resources will discuss indoor plants. Topics covered will include houseplant identification, techniques of propagation, and ecology of native habitat. Materials will be furnished. Arboretum greenhouse; class limited to 15, Saturdays, Nov. 9, 16, 23, Dec. 7; 10-12 noon. 4 sessions, $10.

BONSAI CULTURE FOR BEGINNERS. Mrs. Horace Raphael, authority on Bonsai culture, will teach a series of 10 workshops for beginners. Students receive two trees suitable for Bonsai, and may add their own selections during the course. Each section limited to 12. 10 sessions, $55. (Section A: Tuesdays, Oct. 1, 8, 15, 22, Feb. 18, 25, March 4, 11, 18, April 1; 10:30 a.m.-12:30 p.m. Section B: Same dates as Section A: 7:30-9:30 p.m.)

INTERMEDIATE BONSAI CULTURE. Mrs. Raphael will conduct this series of 10 workshops for students with some experience in Bonsai culture. Each section limited to 12. 10 sessions, $50. (Section A: Wednesdays, Oct. 2, 9, 16, 23, Feb. 19, 26, March 5, 12, 19, April 2; 10:30 a.m.-12:30 p.m. Section B: Same dates as Section B: 7:30-9:30 p.m.)

TO REGISTER: Send check, made payable to the University of Washington, to Arboretum Courses, Anderson Hall (AR-10), University of Washington, Seattle, WA 98195.

FOR FURTHER INFORMATION: Call 543-2730.

This is your Arboretum, kept alive by your support

We are pleased to welcome the following new members (March 1, 1974 through June 30, 1974):

Contributing — Mrs. Gene Grant. *Sustaining* — Mr. and Mrs. Bruce Barbeau, Miss Dorothy Leckenby, Mrs. H. Paske, Maple Hills Carden Club. *Annual* — Mrs. George M. Agner, Jr., Mrs. Richard W. Ahern, Mrs. Per Arne Anderson, Miss Ruth M. Anderson, Mrs. Margaret E. Austin, Mrs. George R. Ayers, Mrs. Cordell H. Bahn, Miss Karen Bloomquist, Mrs. Timothy W. Bortner, Mrs. John G. Brady, Jr., Louis D. Brugler, Mrs. C. E. Cannon, Mrs. Robert D. Carmichael, Mrs. Richard Chartrand, Mrs. Dave Clark, LeRoy P. Collins, Jr., Mrs. Debra Cornell-Haas, Shiela A. Coveny, Janover W. Davis, Mrs. Harold A. Duffy, Mrs. Eugene Dolney, Mrs. W. M. Durflinger, Mrs. H. David Eason, Mrs. Paul Edgar, Mrs. Harold R. Fray, Mrs. Walter F. Gall, Donald A. Gaston, John Gladney, Jr., Mrs. James S. Fox, Mrs. Ann L. Haldeman, Mrs. Owen O. Hall, Mr. and Mrs. Frederick W. Hayes, Mrs. Eugene A. Heath, Mrs. Philip Helms, Mr. and Mrs. Richard D. Holm, Mr. and Mrs. S. Reid Imus, Mrs. Duane R. Johnson, John W. Johnson, Mrs. R. T. Johnson, Mrs. Norman L. Kestle, Mrs. Dale R. LaFay, Mrs. Robert Landregan, Mrs. Frederic Lhamon, Mrs. D. C. Lindberg, Mrs. Mark McCaffrey, George W. McClure, Mrs. James W. McKee, Mrs. Russell F. McNeill, Mrs. Richard W. Melton, Mrs. Jerry Mjelde, Mrs. Jeffry G. Moore, Mrs. Ross Morrison, Melinda Mueller, Mrs. May D. Murray, Mrs. Helen Nelson, Mrs. Charles E. Nicklett, Patricia N. Olson, Mrs. Kenneth E. Overvold, Mrs. A. S. Pederson, Ms. Pamela Perrott, Mrs. Eugene Pfeifer, Mrs. Robert R. Pini, Keith Pitts, Mrs. Donald B. Post, Mrs. Charles H. Prestrud, Ms. Jan Radley, Mrs. Wayne M. Rogers, Blance E. Rosser, Mrs. Richard Roth, Nancy J. Ryan, Mrs. Brian Skidmore, Mrs. Sanford A. Skilton, Mrs. H. Gaylan Smith, Mrs. Paul B. Smith, Mrs. Scott Smith, Mrs. Olive E. Staats, Mrs. Thomas H. Stacy, Mrs. Donald F. Steele, Mrs. John P. Stewart, Mrs. Hal Thompson, Mrs. Terry Thompson, Mrs. William A. Wellck, Miss Roberta Wightman, Mrs. Azalea L. Williams, Mrs. Martha Williamson, Mrs. Shelby Willis, Mrs. Anthony M. Wilson, Mrs. J. E. Wilson, Carl Woestendiek.

We are also grateful to the following members who have increased their dues to: *Supporting* — Mrs. Regnar Brochner. *Contributing* — Ronald Borgford, Mrs. Hans Jorgensen. *Sustaining* — Mrs. Clark Graham, Mrs. J. B. McDiarmid, Mrs. R. B. Nelson, Jr., Mrs. William D. Rourke, Mrs. Donna R. Scardapane, Mrs. J. E. Williams.

ANNUAL REPORTS*
University of Washington Arboretum Report

J.A. WITT
Plant Curator

Staff

Staffing is still a critical situation; it is, however, not as severe as it was last year. We now have nine full time and three part-time on the staff. Mr. Willard Jue retired last December but we were able to regain the services of Mr. Esiquio Narro as Gardener Lead. Mr. Narro had been nursery foreman prior to the budget cut in 1971.

Mr. van Klaveren has been appointed to the University faculty as Lecturer. He will teach University level courses in his specialty, and will continue his popular courses in plant propagation as a part of our Continuing Education program.

Last summer we were given a large number of summer help, mostly young and disadvantaged, who did a fine job of cleaning up many rough areas in the Arboretum—areas where we normally could not get to with our regular staff. We expect to receive similar help this summer but probably not in such quantity.

Two Work-Study students from the University have been working part time as replacements for Mr. Van Denburgh, the Botanical Recorder who retired last year.

Operations

No extensive new projects have been started, since we are largely concerned with maintenance of existing areas and facilities. The water system laid down in the late 1930's is gradually rusting out and we spend an inordinate amount of time in digging and replacing rusted pipes. This process has been speeded up somewhat by using PVC pipe which is much easier to install than the galvanized iron pipes used in the past. Certain areas also have become wet because of clogged drains which are being replaced as time allows and if the need is great enough.

Some re-glazing and repair to the lath houses and greenhouses has been done by the University Physical Plant staff. Much more needs to be done to bring these structures into first class shape.

Plantings

As was the case last year, only a few new planting areas or collections have been developed, and these are quite small: a new camellia bed south of the main collection, an enlarged peony bed, a new box *(Buxus)* bed in the *Euonymus* area, and a planting of junipers and *Ceanothus* on the sunny dry bank below the Isabel Preston memorial are the most important ones. The major planting effort is aimed at improvement or extension of existing collections.

Gifts and Donations

Perhaps the most welcome gifts have been the gift of time given by so many volunteers. This is a highly varied lot that ranges from the very successful Work and Fun Day to Unit 66 which packeted and mailed our seeds for the seed exchange, and to the young man who spent hours in the Japanese Garden weeding because he liked the atmosphere there.

The *Amigos de los Americanos* again used the Arboretum for a work-a-thon and gave us nearly 300 person hours of hard work cleaning brush on Foster's Island and installing a path near the picnic area.

The Japanese Garden received a badly needed pruning and had its paths renewed by Richard Yamasaka and his staff, work that was paid for by the Arboretum Foundation. The Unit Council gave us funds to purchase a new Cushman Truckster, and the Seattle

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*Printed for the first time in the *Bulletin* are reports given at the Annual Meeting, some of them in edited form. Complete reports are available at the Foundation Office. Photos: Jane Rogers

Garden Club gave $1,800 for maintenance of Azalea Way. Many other groups and individuals made similar donations with the total amounting to over $7,300. These ranged from gifts of one or two dollars to nearly a thousand. All are equally welcome.

Perhaps the most unusual donation was from the Lockheed Shipbuilding and Construction Company of nearly 12 tons of urea fertilizer. This was especially useful in this time of fertilizer shortage.

Miscellaneous

Brian Mulligan, Director Emeritus, is well on the way to finishing the Catalogue of plants in the Arboretum and expects to be finished with the typescript sometime in this summer. The catalogue will list nearly every woody plant in the Arboretum with a grid location, date of planting, country of origin, common name, if collected from the wild, and if received from original introduction. This will be a most useful booklet for the serious Arboretum user when it is finally published.

Several small testing projects are under way. We are using a mixture of shavings and sludge from the Metro sewage plant as a mulch and soil amendment. So far the results have been satisfactory, and greenhouse tests indicate no adverse plant reactions to this material.

We are also doing small scale testing of a controlled release slug killer mixed with bark mulch. The results to date have been very good, and we hope to continue with testing this type of material.

Education and public service

Several adult classes in propagation, pruning, photography and other garden related subjects were offered again through Continuing Education programs of the University. All were very well attended.

Mr. van Klaveren gave a series of lecture-demonstrations to staff members of the College of Forest Resources and had a constant stream of high school biology classes for instruction in plant propagation and greenhouse techniques.

Mr. Witt, the Curator of Plant Collections, serves on several local and national committees concerned with horticultural education, and this spring was asked to give a telephone lecture to a horticulture class in Umpqua Community College, Roseburg, Oregon.

Identifying plants and advice on horticultural problems is a continuing service as can be seen from the number of inquiries we receive annually. There is also a constant demand for use of the Arboretum's collection of color slides and black and white photographs. The Arboretum annually receives a number of requests from research scientists and institutions for plant materials. Some of the more interesting requests this year were pollen samples of *Athrotaxus* for W.S.U., Department of Botany, flowers of *Disanthus* from Missouri, pollen of conifers for the Weyerhaeuser Company, *Ilex* (holly) specimens for the National Arboretum and *Acer* species sent to the New York Botanic Garden. We also received plants of a new cultivar of *Mahonia* from Los Angeles to test for cold hardiness.

General

The warm dry summer last year followed by a cool and moist spring gave us one of the finest flowering seasons we have had in several years. The same weather, however, caused problems. First, the grounds remained very wet late into April making it difficult to do routine maintenance work; second, there was a marked increase of fungus diseases, and the Japanese spring cherries are so badly damaged that we feel we may lose some entirely; and third, the grass has grown so rapidly our mowers can't keep up with it.

The last twelve months have been most frustrating to the staff. The political problems involving the very existence of the Arboretum made planning for future development a difficult task. Before even the most simple task was begun a series of decisions had to be made. For instance, we asked ourselves if it was worth spending the time, manpower and money on a project that might be lost because of an unfavorable vote or on the result of a lawsuit. Again for the second year we are "mostly coping" and only a bare minimum of construction work is going on. This is not the way to operate a successful Arboretum, and hopefully next year will see us out of our dilemma and progressing as we should.

Arboretum facts and figures June 1, 1973 to May 31, 1974

Public service activities

Tours, lectures, and demonstrations by staff — 18

Telephone inquiries — 3,101

Plants and cuttings distributed: 157 taxa (kinds) to 38 institutions

Seeds distributed through international seed exchange (distribution done by Unit 66), 2,388 packets to 185 institutions

Acquisitions and additions

Plants, cuttings and seeds received — 387 from 94 sources

Books — 45 (including 23 volumes of *FLORE DES SERRES* published from 1845 to 1880)

Plants set out in Arboretum: 705 plants of 283 taxa (kinds)

Arboretum Staff

Full time — 8

Part-time — 3

Miscellaneous

Traffic count — 107,547

Visitors to Japanese Garden — 49,713

Weather

1973	High	Low	Precipitation in inches
June	90	38	2.90
July	90	44	0.32
Aug.	84	44	0.77
Sept.	88	38	1.73
Oct.	69	38	3.00
Nov.	58	26	8.58
Dec.	52	30	9.62
1974			
Jan.	54	15	8.56
Feb.	54	29	3.86
March	60	26	6.36
April	74	32	1.76
May	74	36	1.96
Total			49.42

(20-year average: 41.28)

Report to the Membership

JOHN A. PUTNAM
Immediate
Past President

On June 13, 1974, at the annual meeting of the Arboretum Foundation, a new slate of officers and board members was presented to the membership and elected. I am very pleased to turn the responsibilities of president over to Mr. Stewart Rogers who I know will serve you well. Names of others on the slate, a group of competent people, are located elsewhere in this bulletin.

In addition to the annual dinner, two other important events brought this spring's activities at the Foundation to a close. Work and Fun Day, under the direction of Shirley Veblen, and the Plant Sale under the direction of Marge Clausing, were both well planned and carried out and were highly successful events. Our thanks to both these dedicated women and the people who have worked with them.

As president, I wish to thank the officers, board members, and committee chairmen and their members for their fine efforts these last three years. I have enjoyed working with them. I am sure the membership is as appreciative and proud as I am of the great many talents these persons bring and the efforts they put into making the Foundation as smooth running, productive, and supportive as it is. They have brought expertise from a wide variety of areas—banking, business, law, landscape architecture—not to mention the common concern that binds them together—the support of the Arboretum.

I would also like to thank every member of the Foundation for his and her interest and support. You are the Foundation.

I would like also to express my gratitude to Dr. Dale Cole and other members of the University faculty, who have responsibilities toward and scientific interest in the Arboretum; to Joe Witt and his staff, whose dedication I have commented on in a previous bulletin; to Marilynn Holm and Velma Beach, whose interest, patience and hard work have kept the Foundation office organized, helpful and productive; and to Jean Henderson, who has done an excellent job with the public relations activities.

As the new officers and board members take over, I wish that I could say there were not items of unfinished business for them to inherit—that the future of the Arboretum is assured, that the lease arrangements between the City and the University have been signed, that those who would have the Arboretum as a common park could see it from a far less self-serving and narrow viewpoint than they do now, that the Seattle community saw the contested issues clearly. But these things have not come to pass and so the officers and board members you have selected will have them to contend with as well as new problems. I am sure that they will be capable of promoting the Foundation's goals and interests and hopefully will help to secure the future of the Arboretum at Washington Park as a true arboretum under the direction of the University of Washington for the continuing benefit of Seattle and its environs.

Arboretum Foundation Nominating Committee Report

The following report was submitted by the Nominating Committee and adopted unanimously by the membership of the Foundation at the Annual Meeting June 13, 1974:

Officers for 1974-1975: President, N. Stewart Rogers; Vice Presidents, Prentice Bloedel, Mrs. Gordon Logan, Mrs. Moritz Milburn, Captain W. R. Wilson; Secretary, Mrs. Allen D. Moses; Treasurer, Phyllis Cavender.

Board of Directors — re-elected for three years: Neil D. Adams, M.D., Bellingham, Robert J. Behnke, Mrs. H. P. Clausing, James K. Fukuda, Mrs. Robert D. Reed, Tacoma. Newly elected for three years: Mrs. Jay Decker, Calhoun Dickinson, Donald Graham, Jr., Kenneth Sorrells, Giacomo Pirzio-Biroli, M.D., Mrs. John S. Robinson.

Robert Behnke, Rosamond Engle,
John S. Robinson, N. Stuart Rogers,
Ruth Vorobik, Chairman.

Unit Council Annual Report

MRS. GORDON LOGAN
Unit Council
General Chairman

This report of my first year as Unit Council Chairman reviews the record of a group of talented, capable and devoted people.

Joan Arnold, Membership Chairman, heads a committee of ten district representatives, who aid our seventy-nine units with programs, fund raising, or any other problems they may have. They aid in forming new units and placing new Foundation members into units. May 30, the Unit membership totaled 1,524. Two new units were formed during the year, Units 84 and 77. From June, 1973 to May, 1974, 117 new people joined units.

Education Chairman Lee Clark set up seven cutting parties in private gardens; fifty-two people attended and propagated choice plant material. Lee arranged four interesting programs for the Unit Council meetings: Susan Barnett from the Gazebo in Bellevue gave a demonstration of terrarium and container planting; Mr. and Mrs. Brian Mulligan shared their pictures of and experiences in

European gardens; Mr. William Yorozu, the general contractor, told of the early development of the Japanese Garden; and Mrs. Joseph Witt told about "The Fascinating Hobby of Vegetable Dyeing."

Lee is also in charge of our Study Groups: Rhododendrons, House Plants, Northwest Natives, Rock Gardens and Bonsai. She also set up a Fall and Winter lecture series given by Miss Roberta Wightman, a Landscape Architect from Seattle, titled "Landscaping your Garden from the Ground Up—or—Let's Do It Right the First Time!" Eighty-nine people attended.

The Arboretum Explorers, another of Lee's responsibilities, toured the Arboretum every fourth Wednesday except in December. The tours, open to the public, leave from the Arboretum parking lot at 10:00 A.M.

Jeannine Bannick, Hospitality Chairman, arranged for meeting places, food, hostesses and supplies for four Unit Council meetings and for the monthly board meetings.

Horticulture Chairman Betty Gray brought plant material, horticultural information about each plant, and good plant combination ideas to Unit Council and board meetings. She also arranged for arboretum plants for door prizes at each Unit Council meeting, for the Unit Program Year Book winners and for the winner of the Thorgrimson Cup, awarded annually to the unit that has done the most during the previous calendar year to benefit the Arboretum. Unit 66, the Vivian Mead Unit, was awarded the cup this year, primarily for their participation in the Arboretum seed exchange program. Unit 89 was awarded first place for the best program, with Unit 42 second and Unit 17 honorable mention.

Third Vice-Chairmen Margaret Miller and Emmy Soderburg, in charge of the Patricia Calvert Greenhouse, met every Tuesday and the third Friday with their crews, fifty-seven women and two men. They held four cutting parties for different units. Three classes of the Seattle Public Schools toured the greenhouse, one class making cuttings from material the greenhouse supplied. The crews propagated over 350 different types of plants. This year they propagated various alpines and sub-alpines, many of which were replanted on Cascade Pass in the North Cascades National Park in connection with a National Park Service Project. This is the first time these species have ever been propagated at sea-level and replanted in alpine areas anywhere in the United States. The greenhouse-propagated plants generated income for the Unit Council of $1,215.00.

Our School Program, under the leadership of Doris Taggart, tallied sixty-four classrooms visited. Twenty-seven visitations were in preparation for trips to the Cleveland Forest, Camp Casey. Twelve presentations were associated with follow-up visits to the Arboretum. Sixty-three visits were to elementary schools and one visit to a high school. Guides have led small groups from four classes along the trails in Cleveland Forest. Seven visits were made to the Children's Orthopedic Hospital.

Another part of our Guide Program is the Native Trail in the Arboretum. Chairman Diane Morgan and twenty-five active guides conducted seventy tours involving 1,139 people: fifteen elementary schools, two high schools, one college botany class, one preschool, two senior citizen's groups, nine youth groups, five arboretum units and two garden clubs.

The Japanese Garden guides, led by Dede Weber, conducted nineteen tours involving some 500 people through the Japanese garden—150 adults and 350 children.

Helen Horrigan headed the research committee who established and processed the Plant Sale list. Helen also went through cartons of *Sunset, Horticulture* and nursery catalogs and clipped articles for the files at the Arboretum office for the units to use in their programs. She also collected pictures and specimens of plant material for the Plant Sale.

Phyllis Morgan, our publicity chairman, gathered material from the units and various committees to give to Jean Henderson, the Foundation Publicity Director. Phyllis also wrote "Unit Conversations" for the *Bulletin.*

Jeanne Gardiner was Chairman for our most successful Fall bulb sale which brought in a profit of $3,000.00 this year, up from $1,600.00 last year. She organized the test bulb garden outside the Arboretum office and also wrote our "Unit Quarterly News" which

includes information of the year's events, horticultural information, and all pertinent Unit Council news.

Our Finance Chairman, Ruth Vorobik, and her committee were responsible for the yearly budget. This year $6,606.00 was given to the Arboretum through the University: $2,260.00 for a truckster, $550.00 for travel expenses and $3,796.00 by unit speakers, garden clubs and individuals. Unit 10 bought a new typewriter table, a computer, a typewriter, and repaired the stapler for the Arboretum office. Several units purchased copies of *The Long Road Travelled* for their local libraries.

Ruth Mary Close and Nancy Hewitt, Unit Program Planning Committee, revised and updated the speakers' list which includes available speakers, gardens to tour, and slide programs. They met in late May with Unit Chairmen and Program Chairmen.

Gladys Swope maintained our ten slide programs and worked to prepare a new one on wildflowers.

The Herbarium Committee, headed by Ruby Williams, added 225 specimens to the permanent collection, making a total number of nearly 650. Duplications were made so that other programs could use them. When the National Arboretum in Washington, D.C. requested some of our specimens, we were pleased to be able to supply them from our duplicates.

On Work and Fun Day, April 18, with Chairman Shirley Veblen, thirty-two units totalling 144 workers, plus the youth group *Los Amigos* and a group of Campfire girls, helped to weed the Arboretum. Joe Witt said that they hauled away more weeds than ever before! Fourteen members of the Prentice Bloedel Unit 86 worked the most hours—sixty-seven hours in the Japanese Garden. Second place went to Unit 6 who had eleven members who worked thirty-seven hours. A special award went to the Cascadians, Unit 21; they pulled nettles!

Marge Clausing headed up our most successful plant sale ever! Her report of that sale is given on page thirty-two of this *Bulletin.*

The Unit Council thanks Marilynn Holm, Executive Secretary and Velma Beach who helped to keep our records, handled the finances, mailing, printing and endless notices. We also thank Mr. Witt who reports to our Unit Council meetings on Arboretum activities, provides plants for our door prizes, Thorgrimson Cup winnter, year book winners, and Work and Fun Day. He also provides horticultural material for our meetings.

The Unit Council and its members continue to work very hard to help the Arboretum and to educate our members and the community.

Japanese Garden Report

John S. Robinson, Chairman

The Japanese Garden has never been more beautiful. The garden has matured and since the trees and shrubs have been pruned it is truly an authentic Japanese Garden. Financial support from the Arboretum Foundation provided funds for the pruning plus new wooden pathways, and crushed rock was added to the paths.

Members of Unit 86, the Prentice Bloedel Unit, spent many hours weeding the garden and assisting with general maintenance.

I had hoped to be able to give you estimated replacement costs for the Japanese teahouse and am sorry these are not available. Hopefully a quotation will be forthcoming in another month. Several donations have been offered to help replace the teahouse and certainly there will be others willing to join a fund raising effort once we are able to proceed.

Itea ilicifolia **in bed W. of magnolias. In full bloom; tassels 6-9 inches long, greenish-white. Very slight fragrance. Photo: Don Normark**

Arboretum Spotlight

Itea ilicifolia — Hollyleaf Sweetspice

Certain shrubs are grown for the beauty of their flowers; roses, and mock oranges *(Philadelphus)* are good examples, others for their form and texture. The dwarf conifers and Japanese holly *(Ilex crenata)* would fit this catagory. A third group are those shrubs which have attractive flowers and great beauty of form; perhaps the rhododendrons would be the prime example of these, but we certainly could include *Itea ilicifolia*.

The hollyleaf sweetspice (the only common name I've been able to find for this shrub) is an evergreen relative of the escallonias and *Philadelphus* that is native to central China where Dr. E. H. Wilson, one of its introducers, found it common on the cliffs of the Yangtse river near Ichang, Hupeh province. He described it as a shrub 1-3 m (3-10 ft.) tall with leaves so similar to the common holly that the plant might easily be mistaken for that totally unrelated plant. Perhaps our specimens are not typical of what Dr. Wilson saw but I, at least, would find it difficult to confuse the two. The leaves of the *Itea* are spiny-toothed and evergreen but they resemble more closely the leaflets of certain Oregon grape *(Mahonia aquifolium)* forms. They are rather thin textured and tend to be somewhat convex. The habit of the shrub is also very distinctive. It forms a wide spreading green mound with arching branches clad in dark glossy green leaves 2 to 4 inches long. In flower it could never be confused with either Oregon grape or holly. It blooms in August with foot-long arching racemes of tiny green-white flowers.

It is a most attractive plant for a protected site in a woodland setting. We have had some difficulty with it being injured by severe cold; however, plants set out in 1952 in a bed with overhead shelter from tall maples and cedars are still thriving although they were nearly defoliated during some of our colder winters.

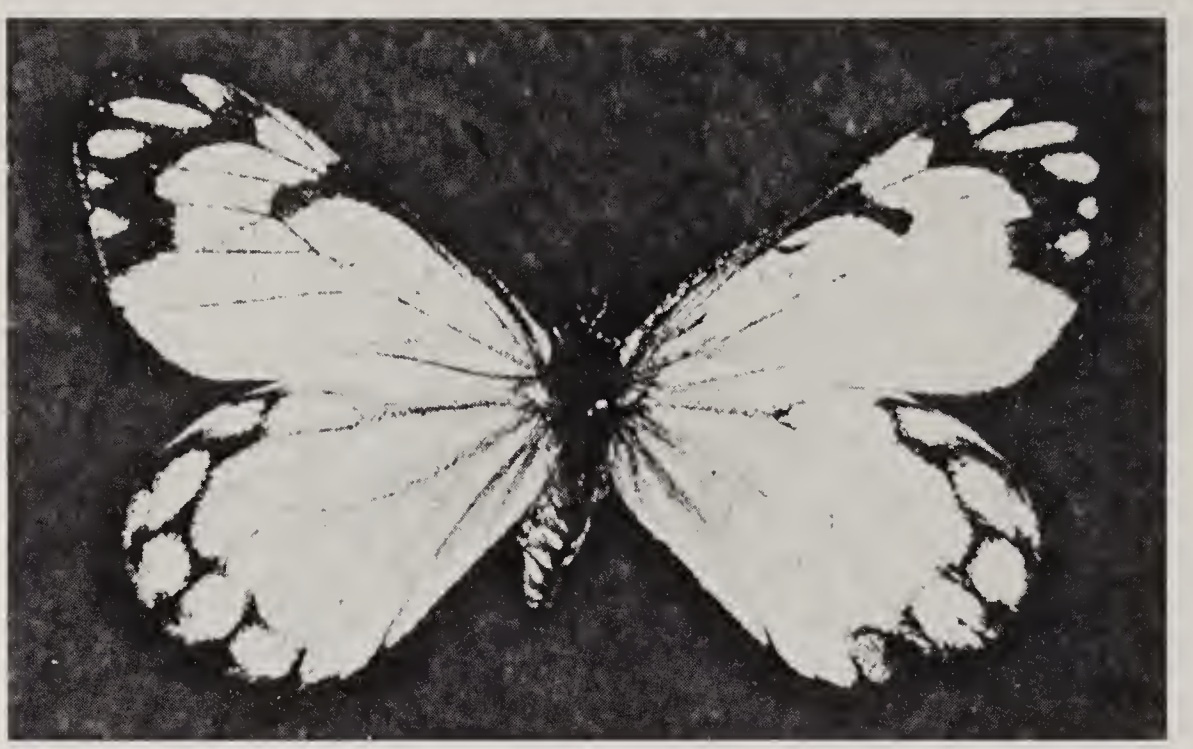
Not common in the nursery trade, *Itea* can be found in some Seattle gardens where its pendulous flower clusters and fresh green leaves give it a distinct air of coolness during the warm weather.

J. A. WITT

What's *Bugging* your PLANT?

*SHARON J. COLLMAN**

2. *Saga of the Pine Butterfly*



Adult female with orange and black markings on the hindwings. (Magnified about 2x). The adult male has the same markings on the forewing, but none on the hind wings. Photo: Sharon Collman

Clouds of white butterflies emerge as if suddenly awakened by the spell of summer. Looking up, high among the Douglas-fir and pine, one is amazed that so many butterflies of a single kind can still be found in one place. One could enjoy forever the spectacle of these light, airy butterflies, gently fluttering, almost stalling then recovering into a more determined flight—as if awakened from a daydream. But rising somewhere from within, comes the voice of reason, the unconscious protector of home and property. After all these are bugs and BUGS EAT PLANTS, and OMIGOSH, look how many there are!

The beauty and grace are gone and in their place is an imagined scene of winged creatures bent on wholesale destruction. The enjoyment is gone and the wonder changes to concern.

As the weeks go by, there is no change. Still *they* can be found, 15 to 30 at a time, everywhere and anytime one looks. But the fretful watcher hardly notices that the butterflies have begun to flutter more slowly, exhausted by the weeks of mating and egg-laying. They fly lower and lower, ever more slowly, and become fewer and fewer. Some flutter exhausted to the sidewalk or fall prey to a quick cat or struggle feebly from a spider's web. Finally, to the gardener's relief, they are no more. Their cycle has come to an end . . .

But high in the tree tops of the Douglas-fir and pine, at the tips of the needles, small emerald-green, football-shaped eggs lean against one another as they wait for the onset of autumn, the passing of winter, and the beginning of spring.

By now, forgetting the pine butterfly, the gardener gets to the task of putting the garden in order. The air becomes crisp, the days dark and short. Leaves fall, winds blow and rains begin, marking the start of a progression of rain, darkness, a little snow and more rain, wind, dark and damp. Yet somewhere high in the Douglas-fir and pine, all is recorded in the small, emerald-green, football-shaped eggs leaning against one another at the tips of the needles.

One small, green caterpillar after another pushes through the egg's thin shell. The caterpillars make their way to the tip of a nearby needle, line up in a circle around the tip, and

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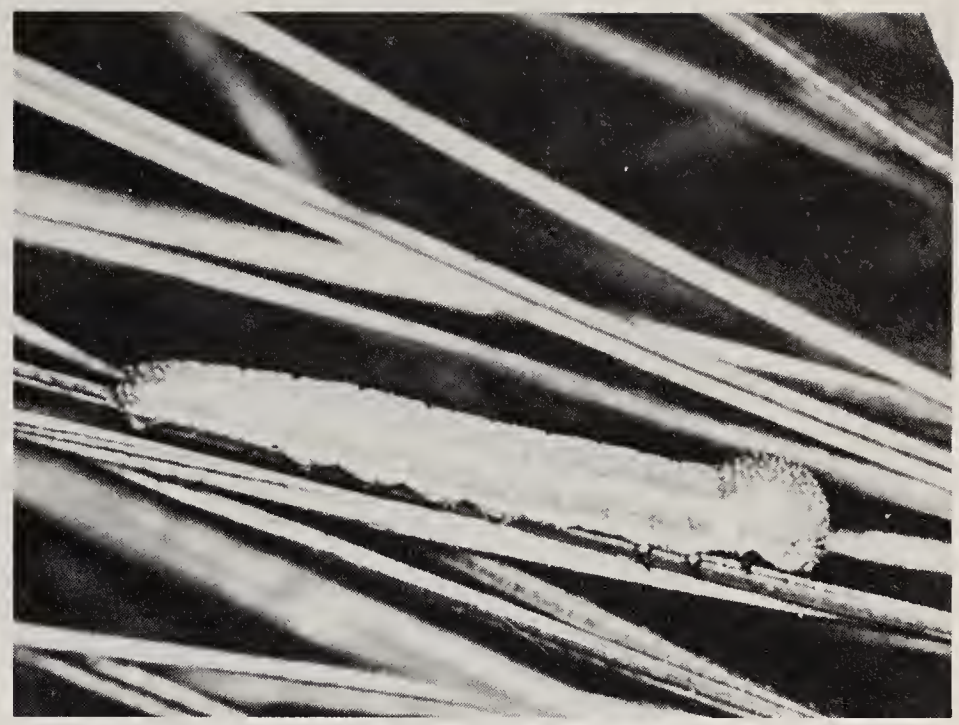
*Sharon Collman is the County Extension Agent in Horticulture for King County. She has received a Master of Science degree in Ornamental Entomology at the U. of W.

Small, emerald-green, football-shaped eggs at the tips of the needles. Ca. 9x Photo: Sharon Collman



Late instar Larva on a pine needle. Ca. 2x Photo: Sharon Collman

begin to eat their way to the bottom. Finished with one, they move to another and another. And so it goes, up and down, up and down. As needles are eaten, the caterpillars grow and soon they don't all fit on one needle, so they split into smaller and smaller groups until at last, there is only one caterpillar to a needle. By then they are nearly full grown and their appetite begins to subside. Far below, the gardener is neither aware of their presence nor is he aware of the loss of those few needles that have been consumed high above.

By mid July the caterpillars are mature and restless and ready to become adults. At this time they are about one-inch long, pale-to-dark green, with one white stripe along each side.

The green body and oversized green head are speckled with white spots and clothed with fine short hairs. Finally, ready to become adults, they begin to drop from silk threads to the foliage and plants below. Some land in waiting spider webs, or are grabbed by assorted predators, parasites or entomologists, while others land on unsuspecting gardeners—"as much of a shock to he as thee." But most descend safely and search for a protected place in which to pupate. Once hidden, they fasten their tip end to a twig or needle and spin a thread-like support around their middle.

Now carefully secured, the most delicate of changes takes place. The caterpillar sheds its skin, and emerges as a chrysalis or naked pupa. Within the outwardly quiet chrysalis a multitude of changes take place. Body organs, muscles, and structures undergo drastic remodeling to make the changeover from a green, wingless, long-bodied, sexually-immature chewing caterpillar to a black-and-white, winged, short-bodied, sexually-mature, non-chewing adult butterfly. All these changes are accomplished in about ten days, when the pupal skin splits and the wrinkled butterfly emerges. Within a short time the wings expand fully and dry. The butterflies have a wingspan of 1½ inches, black bodies, and white wings with black markings. In addition, the females have orange markings on the hind wings.

And so the cycle begins again. Large numbers of white butterflies flutter around the pines and Douglas-firs, causing concern among gardeners below. Yet little is to be feared from this insect in Western Washington. Conditions here somehow do not favor high population buildups, thus damage is relatively minor.

Since the females prefer to lay their eggs in the top portions of the tree, the gardener never sees the minor damage that is done. And since the damage does little harm to the tree, there is little to worry about.

(In Eastern Washington a different picture develops. There, the combination of conditions hot dry weather and acre upon acre of host material-favors the pine butterfly rather than the tree. In Eastern Washington and Idaho several thousand acres are being defoliated by the pine butterfly. The gardeners there should be concerned if they live in an area of infestation.)

Naked chrysalis, or resting stage, attached to the needle. The chrysalis is bright green when first formed, then becomes transparent just prior to emergence. At this time the white of the wing can be seen. Ca. 3x Photo: Sharon Collman

In Western Washington the climate and conditions permit the gardener the luxury of enjoying the graceful beauty of the pine butterflies as they engage in the task of laying small emerald-green, football-shaped eggs, at the tips of needles, high on the tops of the Douglas-fir and pine. ▲

SOME OF OUR FAVORITES
Won't You Send Us Yours?

*GLEN HUNT**

Nandina domestica, Sacred bamboo

N*andina domestica* is my favorite plant. I selected it as a garden designer and not a connoisseur of plants. Finding one plant that is the most versatile in the landscape—one that will be compatible with a variety of soil conditions, will fit into any exposure (sun or shade), and will *blend* or *contrast* with many other beautiful shrubs, trees, flowers and bulbs—is a challenge.

Nandina is native to China and Japan. In our plant zone it will grow to a height of six to seven feet under ideal growing conditions —rich, well-drained soil, receiving plenty of moisture in the growing season. It has panicles of white flowers followed by red berries in the fall of the year. It will tolerate other growing situations.

Its pinnately compounded leaf is the design advantage of this plant. It lends itself to plant masses behind, in, and around heavy-textured shrubs like hybrid rhododendrons. Because it grows six feet high, lower growing shrubs can be planted at its base to enliven its texture. It can be used as a single plant accent or in planting tubs.

When planted in rows or masses its individuality predominates. *Nandina* is a good background plant for herbaecious perennials and bulbs. Exposed to the sun its leaves will take on a reddish tinge, and one of its subtle interests is the new growth as it unfolds in the spring.

Yes, *Nandina domestica* is one of the most versatile plants for Pacific Northwest gardens. ▲

*Mr. Hunt is a member of the Foundation Board of Directors.

A FEW FACTS ABOUT LEAVES

*EDGAR THOMAS**

Mother Nature goes about on autumn days with a liberal supply of paint with which she colors the leaves of the trees and other plants and thereby produces the riot of red, purple, orange and yellow found in the woods. Every year at this time we revel in the beauty of the trees knowing well that it is only a fleeting pleasure. Before long the leaves will flutter away from their summer home and become a part of the rich carpet that covers the forest floor.

Many people suppose that Jack Frost is responsible for the color change but this is not so. Some of the leaves begin to turn before we have any frosts. We know that changing in coloring is the result of chemical processes which take place in the tree as the season changes from Summer to Winter.

All during Spring and Summer the leaves have served as factories where most of the foods necessary for the trees' growth are manufactured. This food-making process takes place in the leaf in numerous cells containing the pigment chlorophyll which gives the leaf its green color. This chlorophyll absorbs energy from sunlight and uses it in transforming carbon dioxide and water to carbohydrates such as sugars and starch. Along with the green pigments, leaves also contain yellow or orange carotenoids—which, for example, give the carrot its familiar color.

In the fall, partly because of change in the period of daylight and changes in temperature, the leaves stop their food-making process, the chlorophyll breaks down, the green color disappears and the yellowish colors become visible and give the leaves part of their fall splendor.

At the same time other chemical changes may occur and cause the formation of additional pigments that vary from yellow to red to blue. Some of them give rise to the reddish and purplish fall colors of leaves of trees such as dogwood and sumacs. Others give the sugar maple its brilliant orange or fiery red and yellow. The autumn foliage of some trees, such as quaking aspen, birch, and hickory, shows only yellow colors. Many oaks and others are mostly brownish, while beech turns golden bronze. These colors are due to the mixing of varying amounts of the chlorophyll and other pigments in the leaf during the fall season.

The degree of color may vary from tree to tree. For example, leaves exposed to the sun may turn red, while those on the shady side of the same tree or other trees in the shade may be yellow. The foliage on some tree species just turns dull brown from death and decay and never show bright colors.

Also the colors on the same tree may vary from year to year depending upon the combination of weather conditions. When there is much warm cloudy weather in the fall the leaves may have less red coloration. The small amount of sugar made in the reduced sunlight moves out of the leaves during the warm nights. Thus no excess sugar remains in the leaves to form the pigments.

As the fall colors appear other changes are taking place. At the base of the leafstalk where it is attached to the twig a special layer of cells develops and gradually severs the tissues that support the leaf. At the same time Nature heals the break, so that after the leaf is finally blown off by the wind or has fallen from its own weight, the place where it grew on the twig is marked by a leaf scar.

Fallen leaves contain relatively large amounts of valuable elements particularly calcium and potassium, which were originally a part of the soil. Decomposition of the leaves enriches the top layers of the soil by returning part of the elements borrowed by the tree and at the same time provides for more water absorbing humus.

It takes twenty-seven leaves to furnish nourishment for a ten-inch apple, the smaller the apple the less leaves. A scrapbook of leaf prints with the names of trees is an interesting project for any boy or girl. ♠

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*We are pleased to print this article by Mr. Thomas, a Foundation member. We hope other members will want to volunteer an article as he has done.

UNIT CONVERSATIONS

There once was a plant sale committee
42 gals from all 'round the city;
They worked day and night
With all of their might
No task was too big or too bitty.

Few complaints, few slip-ups had they,
But the chairman was oft' known to pray;
When the Big Days arrived
They not only survived
They performed in a most excellent way.

Now the plant sale's past history, you know.
And some money we do have to show—
But far greater than that,
And I take off my hat
To Good Friends and Good Times of our Show!

P.S.R.A.F.—the slogan for the 1974 Plant Sale stands for Plant Sales Really are Fun.

Actually, as everyone knows, plant sales are a lot of people doing hours of hard work but we felt if we adopted the philosophy that they were FUN, it might take some of the sting out and we *would* have some fun along the way. And I think we did! Besides Plant Sales are a wonderful opportunity for our members to learn more about plant material first hand.

The sale, held at the Arboretum on May 2nd from 4 to 8 pm and on May 3rd from 10 am to 4 pm, had 33 departments, 42 members on the committee, and approximately 500 people working.

The Weather-Man was good to us. It was rather cool (good for plants and workers) on set-up days but then when Show Day arrived, the sun shone gloriously; this always helps bring out the shoppers.

Our plant sale is one of our best times to meet the public and make new friends and members; this year's plant sale has thus far given us 13 new members in the Arboretum Foundation.

The plant sale always offers to the public an array of hand-selected plant material not otherwise available in one place at one time. It includes: Azaleas, Bonsai, Books, Ferns, Fuchsias, Indoor Plants, Geraniums, Ground Covers, Heathers, Trees and Shrubs, Herbs, Sempervivums and Sedums in the Neglector's Corner. Fun things and inexpensive plants in the Children's Corner, Geraniums, Perennials, Vines, and Rhododendrons.

This year we added Edibles, for the current interest in "grow your own grocieres" and included vegetable plants, berries, fruit trees, and pre-planted patio gardens. Few of a Kind and Bulbs was a collector's corner for alpine and rock garden lovers and carried a large selection of unusual and summer flowering bulbs. Old Fashioned Roses were sold for the first time by the Perennial department and proved very popular, perhaps because of the nostalgia about the roses that Grandmother used to grow. The Bonsai department included an exhibit of finished bonsai as well as bonsai materials for sale. Indoor Plants department more than tripled their stock purchased from the previous year (same chairmen) and sold everything! (Arboretum Foundation Plant Sales keep up with current interest and trends!) The Master Gardeners and 12 Landscape Advisors came and seemed happy to be there and offer their services; they added a lot and we appreciate their gift of time and help.

Barnum and Bailey call their circus the Greatest Show on Earth and they have 3 rings; we had 33 ! ! !

Our customers kept 16 people busy as Cashiers at each shift and used up 700 cardboard boxes in the first 4 hours of the sale; there were 301 Pre-Orders of some 3250 plants; our donated material was over 3500 plants by 75 donors; our own Patricia Calvert Green House produced 2000 plants for the sale—of which 1500 were sold; we sold $31,000 worth of material for a profit of $16,133.82.

It was indeed "fun" to be the plant sale chairman for the Arboretum Foundation in 1974. I had a wonderful assistant, Jayne Waldron; a good advisor, Jody Logan (Unit Council Chairman); a great and co-operative "crew," and much help from both the Arboretum Foundation and Arboretum staffs. I wish to congratulate and thank all of those who had a part in it. ▲

Marge Clausing
1974 Plant Sale Chairman

(continued from p. 17)
are still) extracted by boiling and treating with ammonia. The resulting mixture dyes wool various shades of purple, red, and brown. The ancient Greeks obtained a valuable purple dye. Harris tweeds produced today in Scotland are dyed with lichenic pigments. And finally, those who remember their high school and college chemistry classes may be interested to discover that the ubiquitous litmus (as in litmus paper) is derived from lichens.

Lichens have also been used throughout history for medicinal purposes. Lung and liver diseases, cranial problems, and rabies were treated by various lichens, often ones with a physical similarity to the organ to be treated. Even today in Sweden, China, and India, lichens are eaten for a variety of ailments.

It is not surprising to find that many traditional medicinal lichens have active and effective ingredients. Antibiotics, orginally discovered in *Penicillium* and other fungal genera, have been found in some lichens. Most American species have been tested for medicinal value, but few have so far proven useful. In Europe, an antibiotic salve containing a yellow lichenic pigment, usnic acid, is used to treat external burns and wounds. Other forms of this acid are used to treat tomato canker and various plant diseases.

Lichens may be of greatest service to mankind in the future as biological meters of air and radiation pollution. In spite of their high resistance to most environmental extremes, lichens are very sensitive to air pollution, and to sulfur dioxide in particular. This toxic gas alters the chlorophyll in the algae, impairing photosynthesis. Lichen deserts are created by high levels of pollution and have been documented for most industrial cities, including New York, London, Caracas, Montreal, and Newcastle. Single smelters and industrial plants are reported to have killed most of the lichen flora as far as eighteen miles downwind. Large lichen deserts have been created in heavily industrialized regions all over the world. Holland is an extreme example with lichen deserts extending over large areas of rural country-side. Such sensitive plants can be used as biological metering devices for regional air pollution. Areas of intense pollution can be pinpointed and mapped. As a pollutant is eradicated, the re-colonization by lichens is a useful index of area recovery.

Lichens can also be used to meter radioactive fallout. Since radionuclides are accumulated in the thalli and not washed out, lichen radioactivity provides an efficient meter of cumulative amount and age of fallout.

Conclusion

I ought to conclude this article by answering my original question—why lichens seem to prefer hardwood trunks to conifer trunks in the Pacific Northwest. The answer probably has to do with the types of resins and toxins found in different barks. However the inclusion in this article of the many qualifying terms and phrases such as "probably," "perhaps," "it is thought," "speculation," etc. must provide the hint to the answer I must give, which is none. In other words, there are still many unsolved questions concerning lichens, including, unfortunately, the one posed in the first paragraph. ♠

I heavily utilized the books cited in the bibliography. For the amateur lichenologist may I suggest *The Biology of Lichens* by Mason E. Hale, Jr. *The Lichens,* edited by Ahmadjian and Hale, is excellent for the more serious student.

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SUPPORT
YOUR ADVERTISERS

(continued from p. 11)

'Pendula'); a tulip tree *(Liriodendron tulipifera)* eighty to ninety feet high, in flower; a fine *Cedrus atlantica* 'Glauca' of 1890; a dove tree *(Davidia involucrata)* reputed to be only ten years younger although this seems unlikely from the history of its introduction from western China; and a pair of splendid sycamores planted in 1850, *Platanus orientalis* from the eastern Mediterranean region and its hybrid with the American species *(P. occidentalis)*, now to be called *P. x hybrida* instead of *P. x acerifolia*.

The most unusual tree here, however, was undoubtedly the *Ehretia macrophylla* standing alone on a lawn in front of the Orangerie, a native of the Himalaya and western China, planted in 1890. It was about forty-five feet in height and bearing quantities of fragrant white flowers. It is not considered hardy in the London area but was certainly flourishing here.

This park and garden is therefore not only a pleasant place for Parisians to spend a few hours on a warm Saturday or Sunday afternoon but also a place of considerable horticultural and historical interest, well maintained by the city authorities.

We left Paris with sincere regrets two days later by train bound for Grenoble and the mountains of the Haute Savoie, but the story of that part of our tour must await another place and time for its telling.

A fine tree of the Himalayan *Ehretia macrophylla* flowering near the Orangerie at Bagatelle, Paris. Height about 50 feet.

Book Reviews

DYES FROM PLANTS, by Seonaid Robertson. Van Nostrand Reinhold Company, N. Y., Cincinnati, Toronto, London, Melbourne, 1973. Many line drawings, black and white and color photographs. 144 pp. $8.95.

To my mind this is the most useful and inclusive book on vegetable dyeing to appear in recent years. Among the many places that the author has taught in her distinguished career as an art educator and craftsman is our own University of Washington. Her book thus has for Northwesterners the advantage of including some native dye plants rather than being devoted entirely to Eastern American and European species as is so often the case.

The book's nine chapters cover topics of interest to beginners and more advanced dyers alike. Preparation, equipment, and methods are discussed. One chapter is devoted to mordants—the various metallic salts used in binding colors to fibers—with a sketch of their use from ancient times down to the present and recipes for their application to the most commonly used fiber, wool; another chapter gives additional directions for mordanting and dyeing of cotton, linen, and silk. The historical chapter on several of the important plant dyes of the past such as indigo, madder, woad, and weld is especially interesting; sources are given in an appendix for the dyer who wishes to try them.

Nearly half the book is devoted to recipes for the use of common dye plants of field and garden, each with a line drawing, a short description, and scraps of dyer's and botanical lore, past and present. The illustrations, after the manner of old herbals, or redrawn from them, are decorative and suited to the subject matter, if not entirely useful for plant identification. Comments and suggestions from the personal experience of the author and contemporary dyers from various parts of the world add greatly to the interest and usefulness of the book. The recipes are arranged according to the season for gathering the plant materials—

an admirable departure from the usual "by color" method of organization. Those that we tried out gave very good results—they appear to have been amply tested.

Further chapters deal with lichen dyeing—barely mentioned in most books; the planning of a "dye garden" planted to be decorative as well as useful; and finally suggested uses for the dyed fibers in various arts and crafts. Indices of plants by color, and by common and botanical names provide good cross reference, and a bibliography completes the picture.

The book's one weak spot is its color plates. In the several color photographs showing the dyed fibers made up into garments, wall hangings, rugs, etc., the quality of the color reproduction simply does not do justice to the brilliance and variety of the actual plant-dyed yarns.

JEAN G. WITT
(Mrs. Joseph A.)

WILD MUSHROOM RECIPES, by Puget Sound Mycological Society. Second Edition. Pacific Search Books, Seattle, Wa., 1973. (First edition published as OFT TOLD MUSHROOM RECIPES, 1969) 178 pp. $6.95.

Mushroom aficionados of the area will be glad to know that the highly popular book OFT TOLD MUSHROOM RECIPES which has been out of print for some time is again available with a revised cover and under a new title, WILD MUSHROOM RECIPES. The palate-pleasing potentials of wild mushrooms become a culinary reality under the guiding directions of this cookbook devoted exclusively to the many varieties of edible fungi that grow throughout the Pacific Northwest. Compiled by members of the Puget Sound Mycological Society, the line-drawing illustrated book details more than two hundred recipes utilizing some twenty-two species of edible mushrooms found in forest and field of the western coastal mountain region.

Organized by genus—*Agaricus* and *Armillaria* to *Russula* and *Sparassis*—the recipes run the gamut of kitchen artistry from baked fish with mushrooms and mushroom pastry to mushroom puffballs and fritters. The book's six-page index best describes its comprehensive and unique contents through quick-reference subdivision headings: Appetizers, Breads, Eggs and Cheese, Extract, Fish and Seafood, Garnish, Meats, Poultry, Rice, Salads, Sandwiches, Sauces and Gravies, Soups, Stuffing, Vegetables.

The text also features special sections on the precooking care and handling of mushrooms, and on the preservation of mushrooms via canning, pickling, drying, freezing, and salting.

ALICE SEED
PACIFIC SEARCH

THE LEAF BOOK, by Ida Geary. The Tamal Land Press. 381 pages. $4.95.

This delightful book is sub-titled "A Field Guide to Plants of Northern California," and it is therefore a thoroughly satisfactory gift for any nature-loving people who live in that area. However, inasmuch as many of the plants and trees covered are found also in our corner of the country, the book would be a welcome addition to our own libraries.

Not only is this volume a very useful nature guide; it is a thing of beauty. Instead of using photographs or sketches as illustrations, the author has employed a centuries-old process to create actual leaf prints of the plants described. This system offers a unique and accurate method of identification and also makes possible a completely beautiful book.

Of special interest is the fact that Mrs. Geary generously gives detailed instructions for making the fascinating leaf prints, so that would-be collectors may create their own.

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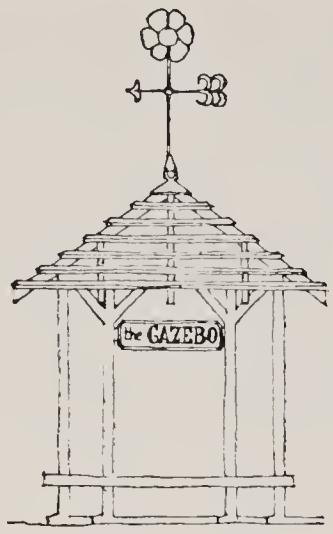

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THE ARBORETUM FOUNDATION
STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS BY FUNDS
YEAR ENDED APRIL 30, 1974*

	Consolidated
RECEIPTS:	
Dues	$ 20,630.00
Donations	6,140.00
Unit Council —	
Plant and bulb sale	23,263.00
Other	9,381.00
Interest on savings accounts and investments	31,599.00
Net income from Investment Trust	868.00
Advertising and miscellaneous	7,869.00
Bequests	147,920.00
TOTAL RECEIPTS	247,670.00
DISBURSEMENTS:	
Salaries and Christmas bonus	14,448.00
Payroll taxes	1,382.00
Membership expense	949.00
Bulletin and publication	10,285.00
Publicity and educational program	1,649.00
Telephone	399.00
Professional services	800.00
Schmitz manuscript	5,996.00
Other operating expenses	749.00
Units Council expenses —	
Plant sale costs and expenses	16,943.00
Utilities, supplies, postage and books	1,097.00
Miscellaneous	8,668.00
Donations to University of Washington Arboretum	7,178.00
Donations to Japanese Garden	4,000.00
TOTAL DISBURSEMENTS	74,543.00
Excess of receipts over disbursements for the year	173,127.00
CASH BALANCES, APRIL 30, 1973	398,716.00
ALLOCATED CASH BALANCE, APRIL 30, 1974	$571,843.00
ALLOCATION OF FUNDS	
General Fund	29,679.00
O. D. Fisher Funds	640.00
Endowment Trust Fund Monies	1,118.00
Floral Hall Fund	115,933.00
Memorial Fund	16,800.00
Japanese Garden Fund	2,933.00
Educational Program — Library Fund	3,477.00
Tolmie Fund	347,015.00
Krauss Fund	54,248.00
FUNDS ON HAND APRIL 30, 1974	$571,843.00
ENDOWMENT TRUST PRINCIPAL — invested in Seattle First National Bank "Investment Funds for Trusts" units	$ 15,888.00

*Financial Statement as prepared by Price Waterhouse & Co. is available in Arboretum Foundation office.

THE ARBORETUM BULLETIN

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UNIT COUNCIL MEETINGS

Four times each year the Unit Council presents an afternoon program open to all Foundation members and to the public. These free programs are given by authorities in their fields and represent a wide scope of interest. Again this year the programs will be given at 1:00 P.M. at the Sand Point Community Methodist Church, 4710 N.E. 70th. Mark your calendar and come enjoy a stimulating program.

September 19, 1974 — SALAL AND ITS RELATIVES
Dr. William Hathaway — College of Forest Resources, University of Washington

November 21, 1974 — CLIMATE, SOIL, ANIMAL AND PLANTS OF KITSAP PENINSULA
Mr. Sigurd Olsen — College of Fisheries, University of Washington

March 21, 1975 — HERITAGE ROSES
Mrs. Edith Schurr — National Chairman of Old Roses, American Rose Society

May 15, 1975 — HUMAN TRAMPLING IN THE WILDERNESS
Mr. Ed Schriner — Graduate Student, College of Forest Resources, University of Washington